BROOKLYN BOTANIC GARDEN

LEAFLETS

SERIES XV BROOKLYN, N. Y., MARCH 16, 1927 No. 1

EPIPHYTES AND HOUSE PLANTS

BROOKLYN BOTANIC GARDEN EXHIBIT

FOURTEENTH INTERNATIONAL FLOWER SHOW

GRAND CENTRAL PALACE, NEW YORK, MARCH 21-26, 1927.

In this exhibit attention is directed to the display of epiphytes ("air plants"), shown approximately as they occur under natural conditions, and to a selection of plants that are satisfactory as house plants, but which are not commonly offered for sale by florists.

Epiphytes or "air plants" are those plants which grow on trees or other vegetation, but which do not rob their hosts of food. Examples of epiphytes are found amongst the orchids, bromeliads (Pineapple Family), aroids, cacti, ferns, mosses, algae, and lichens. All of the above are represented in the exhibit.

The orchids are perhaps better known to the layman than any other group of epiphytes. Included in the exhibit is the Vanilla, *Vanilla planifolia,* a native of Mexico and widely cultivated in the tropics. This is the only orchid of considerable economic importance if we except those that are of commercial value for the beauty of their flowers. *Dendrobium formosum* shows very plainly the aerial roots covered with "velamen," which has the property of absorbing moisture from the air. *Oncidium luridum,* a South American species, is also present.

The best known epiphyte in the Pineapple Family is the Spanish-moss, *Tillandsia usneoides,* familiar to travellers in the South, where it drapes the branches of the trees with its hoary growth. It has some commercial value as a packing material and for stuffing upholstery. Few people realize that it is related to the pineapple, *Ananas sativus,* a plant of prime economic importance, which, as a food and fibre plant is well known, and appreciated, but not so the value of its variegated forms as house plants, represented here by *Ananas sativus* var. *Porteanus.*

In this same Pineapple Family there are many species that are well adapted to withstand the arid conditions of the average dwelling.

Some, such as *Guzmania Zahnii,* one of the most beautiful, and *Vriesia splendens,* increase too slowly to commend themselves to the commercial grower, but most species are easily propagated, either by seeds or offsets, so that their rapid increase presents no difficulty.

Amongst those bromeliads that are recommended as house plants for the beauty of their foliage or flowers, and the ease with which they may be grown, are the following: *Aregelia spectabilis,* whose leaves are tipped with brilliant carmine; *Billbergia thyrsoidea,* a vase-like plant with foliage of rich lettuce green, and bright red flowers; *Cryptanthus zonatus,* which has undulated leaves of green and purple, quaintly marked with wavy, fawn colored bands; *Nidularium Innocentii,* leaves with purple undersides and margins, and with crimson bracts surrounding the white flowers; *Tillandsia fasciculata,* a strong-growing species with scurfy gray leaves; *Tillandsia utriculata,* somewhat similar, with gracefully recurving leaves; and *Vriesia Kitteliana,* having green leaves spotted with red. Other species represented in the exhibit are *Aechmea Barleei, A. fulgens, Bromelia lasiantha, Cryptanthus Beuckeri, Guzmania musaica,* and *G. Peacockii.*

Points to remember in the cultivation of the epiphytic bromeliads are, that their leaf bases should be kept filled with water, and that they should not be potted in soil, but in a mixture of osmunda fiber (fern roots) and charcoal lumps.

The aroids, which are represented in the north, among others, by the well-known Jack-in-the-Pulpit, are very abundant in the tropics, where many of them grow as epiphytes in the forests. In the exhibit are three species that are partly, if not wholly, epiphytal in character. *Monstera deliciosa,* the Ceriman, or, as it is sometimes called, the Swiss Cheese Plant, is conspicuous because of the remarkable perforations in its handsome leaves. It is tolerant of house conditions. *Pothos aureus,* and the Silver Ivy-arum, *Scindapsus pictus argyraeus,* are handsome greenhouse climbers.

The epiphytic cacti are represented by *Rhipsalis grandiflora,* a species far removed from the layman's usual conception of a cactus as being something exceedingly prickly. It is beautiful and interesting when its smooth, round branches are spangled with white blossoms. Huge masses of Mistletoe Cactus, as *Rhipsalis* is sometimes called, are draped from the limbs of the large Saman trees that fringe the savannah at Port of Spain, Trinidad, and indeed are a characteristic feature on large trees throughout that vicinity.

Three genera of ferns in the exhibit serve to illustrate the epiphytic tendencies of some of the members of this great group. Amongst them are the Common Staghorn Fern, *Platycerium bifurcatum,* which in the wild grows with its sterile fronds closely appressed to tree trunks; *Polypodium sporadocarpum;* and the Birdsnest Fern, *Asplenium nidus.* The last named, and the Manda Polypody, a form of *Polypodium aureum,* are excellent as house plants and should be used for that purpose much more extensively.

Mosses are represented in the exhibit by a species belonging in the Hypnum group; algae by *Pleurococcus;* and lichens by *Parmelia.*

Of plants, not epiphytes, that are worthy of a trial as house plants we have, in the Arum Family; *Aglaonema commutatum,* with dark green leaves marked with patches of paler green; *A. costatum,* quite dwarf, and with leaves of dark green, with a white midrib and white blotches; and *Schismatoglottis Roebelinii.* The latter has been described as "a fine house plant." Perhaps if it had a more pronounceable name its popularity would increase. Another plant in this family that has all the earmarks of a good house plant is the Indian Kale, *Xanthosoma Lindeni,* but we have had no reports of its behavior under house conditions.

Florists have drawn heavily on the genus *Dracaena* for house plants, notably in varieties of *D. terminalis* (*Cordyline terminalis*), and *D. fragrans,* but there are two species shown here that have been somewhat neglected, namely the Gold-dust Dracaena, *D. Godseffiana,* and *D. Sanderiana.* The latter is, in the writer's experience, one of the most persistent of house plants under adverse conditions. This species has narrow leaves margined with white. Nearby for comparison is a "sport" from it, with leaves which are entirely green.

Before the days of steam heat, magnificent specimens of such species of *Begonia* as *B. Rex, B. metallica, B. coccinea, B. ricinifolia,* etc., were grown as window plants, and such may even now occasionally be seen in sections where modern improvements have not penetrated. The genus is represented in this exhibit by *B. argenteoguttata, B. imperialis, B. speculata* and *B. Thurstoni,* all of which, with the possible exception of *B. imperialis,* may be expected to succeed under house conditions.

The ubiquitous Rubber Plant, *Ficus elastica,* is well and favorably known, especially in cities, but two of its cousins, while almost if not quite as hardy, are somewhat neglected. The Fiddleleaf Fig, *Ficus pandurata,* has hard, leathery, shiny leaves, possessing much more character than the popular Rubber Plant; and the Mistletoe Fig, *Ficus diversifolia,* is always interesting because of its fruits, which resemble miniature figs.

A fine specimen is shown of the noble *Pandanus pacificus.* Those who have come into contact with its fierce spines are liable to think its specific name is a misnomer, until they realize that it refers to the locale where it is indigenous and not to its disposition! *Pandanus Baptistii* is a very different looking species, with narrower leaves which are entirely unarmed. This fact alone should commend it to florists who are used to dealing with the spiny-leaved species usually grown—*P. Veitchi.*

Ferns have long been favored as house plants. Here are a few that should be added to the list. The Leather Fern, *Polystichum adiantiforme,* is the hardiest of any fern under house conditions that the writer has had experience with, and yet it is seldom, if ever, offered as a house plant. *Davallia solida* and *D. pentaphylla,* relatives of the Ballfern (*D. bullata*), are handsome and likely to succeed as house plants. Varieties of various species of *Pteris,* such as

P. cretica, P. multifida, and *P. quadriaurita,* are good when not exposed to too much heat. This group is here represented by the Crested Spider Brake, a variety of *P. multifida.*

Other plants in the exhibit are *Beaucarnea recurvata; Calathea Sanderiana; Spathiphyllum floribundum,* and a variegated form of the Bermuda Arrowroot, *Maranta arundinacea.*

MONTAGUE FREE.

NOTICES

The Garden is open free to the public daily, from 8 a. m. until dark; on Sundays and holidays from 10 a. m. until dark. The Laboratory Building, containing the library, herbarium, and offices, is open daily (except Sundays), from 9 a. m. until 5 p. m. (Saturdays, 9-12). The Conservatories are open April 1-October 1, 10 a. m.-4:30 p. m. (Sundays, 2-4:30); October 1-April 1, 10 a. m.-4 p. m. (Sundays, 2-4).

To Reach the Garden take Broadway (B.-M.T.) Subway to Prospect Park Station; Interborough Subway to Eastern Parkway-Brooklyn Museum Station; Flatbush Avenue trolley to Empire Boulevard; Franklin Avenue, Lorimer Street, and Tompkins Avenue trolleys to Washington Avenue; St. John's Place trolley to Sterling Place and Washington Avenue; Union Street and Vanderbilt Avenue trolleys to Prospect Park Plaza and Union Street.

Entrances—On Flatbush Avenue (1) near Empire Boulevard (Malbone Street), and (2) near Mt. Prospect Reservoir; on Washington Avenue, (3) south of Eastern Parkway, and (4) near Empire Boulevard; on Eastern Parkway, (5) west of the Museum building.

The street entrance to the Laboratory Building is at 1000 Washington Avenue, between Eastern Parkway and Empire Boulevard and opposite Montgomery Street.

The LEAFLETS are published weekly or biweekly from April to June, and September to October, inclusive, by The Brooklyn Botanic Garden, 1000 Washington Avenue, Brooklyn, N. Y.

Telephone: 6173 Prospect. Mail address: Brooklyn Botanic Garden, Brooklyn, N. Y.

BROOKLYN BOTANIC GARDEN

LEAFLETS

SERIES XV BROOKLYN, N. Y., APRIL 6, 1927 NOS. 2 AND 3

THE WARDIAN CASE:

A DEVICE FOR GROWING PLANTS IN THE SCHOOLROOM OR LIVINGROOM*

A love of plants seems to be almost universal, for most of us like to have them about us in the house as well as out-of-doors, yet many people find it well-nigh impossible to keep plants indoors in a healthy condition. Particularly is this true of plants in the schoolroom, where they often lack care for a portion of each week, and, unless special provision is made, are apt to suffer during the long vacations.

There are many reasons why these indoor plants often become sickly, droop and die, even though they receive constant care; but the chief causes are poor light, dryness of the air, and the presence of dust and gases. The need of light is, of course, essential; as to dryness of the air, this is probably more responsible for the failure of indoor plants than any other cause. The cold air taken in from out-of-doors in the case of furnace-heated houses has a temperature varying from perhaps zero to 45°. It becomes heated to 70° or over, and although the heating vastly increases its moisture-holding capacity, as a matter of fact it contains no more moisture than when it was a cold air. Therefore, it *feels* like a dry air, for its relative humidity is very low. "In Death Valley, California, one of the driest places on earth, the average relative humidity for five months, when the record was kept, was 23; yet this is but *little less than the relative humidity of the air in the average furnace-heated house in winter.*"** No wonder that we take cold after such air parches the membranes in our lungs, and we go forth at any moment into the sharp, chilling air out-of-doors. No wonder that plants also suffer in such a desert environment! And so, for want of knowledge as to how to obviate these difficulties, the attempt to grow flowers or green things in the home or school is often regretfully abandoned.

About ninety years ago, Nathaniel Ward, a London physician, stumbled upon a method of raising and keeping plants in an environ-

* This Leaflet is a reprint, with revision and additions, of Series X, No. 5, 1922.

** Salisbury, R. D., Barrows, H. H., and Tower, W. S. The elements of geography. N. Y., 1912. p. 90.

ment otherwise quite unsuited to them. As a child he had admired the old brick walls often seen in English gardens, covered with mosses, ferns, and primroses; and had built one in London. He tended it carefully, but the London atmosphere was most unfavorable, and one by one his plants died. One day he discovered a sphinx-moth cocoon, and, wishing to see it hatch, put it in a glass bottle containing some rich, damp loam and covered with a piece of tin. To his surprise, in a few weeks a young fern and a small grass plant appeared and continued to grow in the battle, although similar plants had promptly died on his brick wall. Wondering why these bottle plants thrived, he concluded that it was for the following reasons: the air was free from soot; there was plenty of light; the glass kept the temperature even; the moisture was constant; and the air was quiet, yet the lid allowed some ventilation. "Thus, then," he says, "all the conditions necessary for the growth of my little plant were apparently fulfilled; and it remained only to put it to the test of an experiment. I placed the bottle outside of my study—a room facing the north—and to my great delight the plants continued to grow well. . . . They required no attention, the same circulation of water continuing; and here they remained for nearly four years. . . . At the end of this time they accidentally perished, during my absence from home, in consequence of the rusting of the lid, and the admission of rain water."*

Finding that his "bottle" fern grew so well, Dr. Ward experimented with many plants in cases of different sizes and became more and more enthusiastic over the possibilities of growing plants "in closely glazed cases." Speaking of a fern, lovely, but exceedingly "intractable under ordinary methods of cultivation," he tells how "Baron Fischer, the superintendent of the botanical establishments of the Emperor of Russia, when he saw the plant growing in one of my cases, took off his hat, made a bow to it, and said: 'You have been my master all the days of my life.'"

In one glass-enclosed case about 10 feet square, containing small palms and ferns, he kept an English robin for several months, and in another, on the top of his house, he grew alpine plants, which however, finally died from too much sunshine in the summer. He describes how he kept ferns and mosses alive "which had been planted nine years before in the bottle, after the first experimental plants had sprung up and perished. "The soil is a mixture of peat mold, loam, and sand, with as much moisture as it would retain when water was poured through it. The same water has served for the nourishment of the plants up to the present time, nor am I able to assign any limit to their existence in this state."

Dr. Ward's cases found a very practical use in transporting seeds and plants to and from foreign countries. In those days of slow sailing vessels, it was with great difficulty that living specimens were

* Ward, N. B. On the growth of plants in closely glazed cases, pp. 26, 27. London. 1842. 95 pp.

sent from one country to another, particularly when this involved crossing the equator from one hemisphere to another. Rare and delicate plants, often procured at great hazard, were apt to die on the voyage from cold, lack of water, or from the suffocating gases of the hold. In 1833, two cases were filled with ferns, grasses, etc., and sent from England to Sydney, Australia, in perfect condition. There they were refilled with other plants and sent back. The voyage required eight months, the plants being on deck and not once watered, yet they arrived in the most healthy and vigorous condition. The cases permitted the plants to grow in plenty of light and the lack of air currents about them minimized the dangers from sudden changes of temperature.

Figure 1. Wardian Case in Use at the Brooklyn Botanic Garden. Plants (left to right): *Codiaeum evansianum* (broad leaf with veins at right angles to midrib); *Sansevieria thyrsiflora* (narrow leaf with dark bands); English Ivy (heart-shaped leaf); *Peperomia maculosa* (in front, middle); variety of Boston Fern (in rear); *Dracaena deremensis* (long leaves); *Codiaeum aucubaefolium* (right hand corner, in front).

Dr. Ward felt that his cases would do much to brighten the lives of the poor, enabling them to beautify their homes and to raise flowers and vegetables they might not otherwise have. His expectations have hardly been realized, yet the Wardian Case, as it is called,

should be better known. It can be constructed at a moderate cost, requires little care, and in it a variety of plants may be grown, so that it adds greatly to the attractiveness of the home or school.

Construction of the Wardian Case

Cases of a great variety of shapes and sizes may be made: Dr. Ward experimented with many different kinds. The small window garden commonly made with earth and plants in a goldfish globe covered with a pane of glass, is a Wardian case in principle—a fairly tight chamber with sides and roof of glass, and containing air of high relative humidity—in fact, a miniature greenhouse.

A Wardian case similar to that in use at the Brooklyn Botanic Garden may be made as follows: the framework, preferably of soft pine or cypress, for holding the glass, consists of four upright pieces, 1 x 1 x 16¼ inches, with grooves a quarter of an inch deep on two sides for receiving the glass of the sides and ends of the case. For the sloping sides of the framework as well as for the ridgepole, pieces 1 inch thick by 1 inch wide are also used. The floor is made of matched boards about one inch thick, and is perforated with about a dozen holes one inch in diameter, at fairly regular distances apart, for drainage and ventilation. Before the soil, which consists of equal parts of sand, leaf mold and loam, is put in, these holes are covered with crock after the method used in potting plants. Underneath the floor, at convenient distances apart, two cross pieces about one and three-quarter inches wide and an inch thick, may be fastened, on which the whole case rests; so that air freely circulates under the body and has access to the holes in the bottom.

The body of the box, which is fastened directly to the uprights by lap-joints (Fig. 3, AB), is 14½ x 21½ x 6½ inches, outside measure. Material ½ inch in thickness is used. The upper, inner edges of the body boards are rabbeted ⅛ x ⅛ inches to receive the glass. These rabbets must be in exact line with the grooves in the uprights when assembled. A section of the body board, so rabbeted, is shown in Fig. 2. Or, the upper edges of the body boards may be left plane, so that the glass merely rests upon them. The main objection to this latter procedure is that the moisture collecting on the inside of the glass is then apt to escape to the outside of the case. If the glass is set in a rabbet, the moisture, after running down the glass, must be deflected into the interior of the case. Since one of the advantages of the case is the fact that with its contained plants it will go for months without need of watering, any continual loss of water, however slight, would be a serious defect.

Figure 2. Section of body of box showing rabbet at upper, inner edge, to receive glass.

For the sides, two panes of glass 10 x 20 inches are used, and for the ends, two panes 13 x 13 inches, cut at the top end to form the gables. The two slanting panes used for the roof are 20 x 8½ inches. Four removable wooden pins, fitting into holes at the corners of the

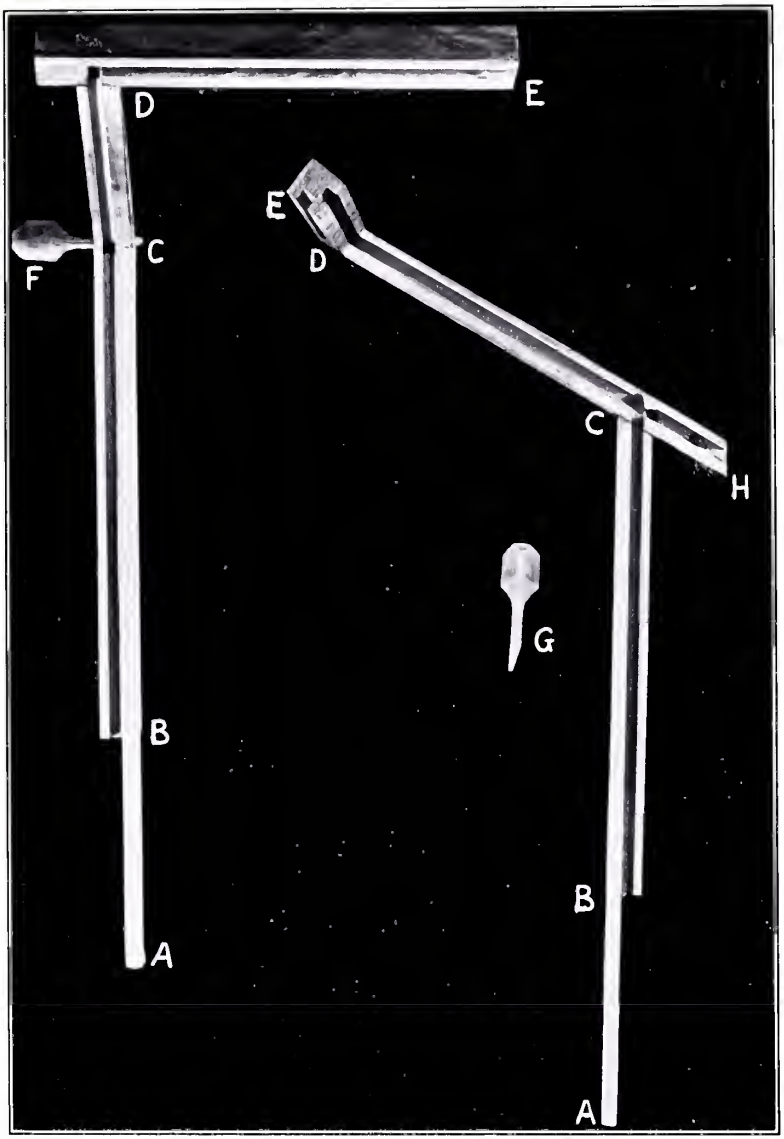


Figure 3. Two views of part of framework at one angle or corner, ACD, including part of ridgepole, DE, showing grooves for glass. BC, vertical upright with grooves for holding side glass panes. AB, lower extension of the upright which overlaps inside on the body of the box (making the lap-joint). DCH, slanting piece grooved on two sides for holding one of the two top glass panes and end glass pane. F, wooden pin in position. This prevents top glass pane from sliding downward. G, wooden pin removed, showing way in which it is trimmed on one side, at lower end.

"eaves," serve as fasteners to prevent the glass roof from sliding down. One of these wooden pins is shown at G, Fig. 3, and also in position at F, in the same figure. The wooden pin can be trimmed or sharpened on one side, as shown in the figure (G), to allow for a loose adjustment of the roof panes. Such a pin, inserted only a little way into the hole, will leave a small space between the slanting pane and the ridgepole, for ventilation, if necessary. Pushed in further, it closes up the opening, bringing the glass pane tight against the ridgepole. Another set of holes, further down, makes it possible, by insertion of the pins here, to have a much wider gap between the slanting panes and ridgepole toward H at the left of the figure. It is well to have this provision for ventilation, for if mold appears on the surface of the soil or if the leaves begin to decay, it is evident that too much moisture is present, and ventilation is then necessary.

It is not necessary to have a peaked roof as is here described and figured. A "lean-to" glass roof may be used, or even a flat roof, but in the latter case, books or other objects are apt to be laid on top, shutting off the light and perhaps breaking the glass. The form with peaked roof shown in the illustration has a neat appearance, and, moreover, by the use of the wooden pegs, the top glass panes may be either held tight to the "ridge pole," or lowered for ventilation, as explained above.

The Warden case exhibited by Mrs. William H. Cary at the International Flower Show (March 21-26, 1927), in the booth of the Garden Club of America, was made in accordance with the specifications contained in this leaflet.

Plants for the Wardian Case

In the selection of suitable species for the Wardian case, the chief points to bear in mind are that they do not become too large or grow too rapidly. Also, some plants do not thrive in such a moist environment, as, for example, the Geranium, which soon becomes affected with mold. In general, the plants must be tough-leaved and not prone to mildew.

Besides the collection of species shown in the figure, many of which cannot be obtained from the florist, the following kinds may be suggested, all of which are readily obtainable:

1. English Ivy
2. *Anthericum variegatum*
3. *Tradescantia* spp.
4. *Cyperus alternifolius*
5. *Begonia Rex* and varieties
6. Small Palms
7. Small Ferns—
   Pteris
   Polystichum
8. *Selaginella* spp.
9. Croton varieties

Cases that are to be left in the schoolroom during long summer vacations may be placed in a north window and left without any care. If they are at a south window, they should be moved back a little so that they will not have too much sunlight, or else they should be partially shaded.

Elsie Twemlow Hammond.

PRIVILEGES OF MEMBERSHIP
IN THE
BROOKLYN BOTANIC GARDEN

1. Free admission to the buildings and grounds at all times.
2. Cards of admission for self and friends to all exhibitions and openings preceding the admission of the general public, and to receptions.
3. Services of docent (by appointment), for self and party, when visiting the Garden.
4. Admission of member and his or her immediate family to all lectures, classes, field trips, and other scientific meetings under Garden auspices, at the Garden or elsewhere.
5. Special lectures and classes for the children of members.
6. Copies of Garden publications.
7. Privileges of the Library and Herbarium.
8. Expert advice on the choice and care of plants, indoors and out, on planting the home grounds, the care of lawns, and the treatment of plants affected by insect and fungous pests.
9. Identification of botanical specimens.
10. Participation in the periodical distribution of duplicate plant material and seeds, in accordance with special announcements sent to members from time to time.

Further information concerning membership may be had by addressing The Director, Brooklyn Botanic Garden, Brooklyn, N. Y., or by personal conference by appointment. Telephone, 6173 Prospect.

CLASSES OF MEMBERSHIP

The Brooklyn Institute of Arts and Sciences is organized in three main departments: 1. The Department of Education. 2. The Museums. 3. The Botanic Garden.

Any of the following seven classes of membership may be taken out through the Botanic Garden:

1. Annual member	$ 10	Donor	$ 10,000
2. Sustaining member	25	Patron	25,000
3. Life member	500	Benefactor	100,000
4. Permanent member	2,500		

Sustaining members are annual members with full privileges in Departments one to three. Membership in classes two to seven carries full privileges in Departments one to three.

In addition to opportunities afforded to members of the Botanic Garden for public service through co-operating in its development, and helping to further its aims to advance and diffuse a knowledge and love of plants, to help preserve our native wild flowers, and to afford additional and much needed educational advantages in Brooklyn and Greater New York, members may also enjoy the privileges indicated above.

MISCELLANEOUS INFORMATION

The Garden is open free to the public daily, from 8 a. m. until sunset; on Sundays and holidays at 10 a. m. Conservatories opened, April 1-September 30, 10 a. m.-4:30 p. m.; October 1-March 31, 10 a. m.-4 p. m.

Entrances: On Flatbush Avenue, opposite Prospect Park; on Washington Avenue, south of Eastern Parkway; and on Eastern Parkway, west of the Museum Building.

The entrance to the Laboratory Building is at 1000 Washington Avenue (opposite Montgomery Street), and also from the Botanic Garden grounds.

To Reach the Garden take Flatbush Avenue trolley to Empire Boulevard; Franklin Avenue and Lorimer Street trolleys to Flatbush Avenue; St. Johns Place trolley to Sterling Place and Washington Avenue; Ninth Avenue, Union Street, Vanderbilt Avenue, and Smith Street trolleys to Prospect Park Plaza and Union Street; Brighton Beach Express, Broadway (B.-M. T.) Subway to Prospect Park Station (north exit); from other trains change at De Kalb Avenue; Interborough Subway to Eastern Parkway-Brooklyn Museum Station (southeast exit); from other trains change at Nevins Street.

A docent will meet parties by appointment and conduct them through the Garden. Arrangements may be made with the Curator of Public Instruction by telephone or mail.

Telephone: 6173 Prospect.

Mail address: Brooklyn Botanic Garden, 1000 Washington Avenue, Brooklyn, N. Y.

For the convenience of those wishing to become members of the Garden, a detachable form is printed below.

(Date).....

THE SECRETARY,
Brooklyn Botanic Garden,
1000 Washington Avenue, Brooklyn, New York.

DEAR SIR:—I desire to become a member of the Brooklyn Botanic Garden in the class indicated below, and authorize you to present my name to the Board of Trustees for election. Enclosed please find remittance.

Annual	$ 10	Permanent	$ 2,500
Sustaining	25	Donor	10,000
Life	500	Patron	25,000
		Benefactor	$100,000

Yours truly,

Name.....

Address.....

Please give your name and address precisely as you wish it to appear on our mailing lists.

BROOKLYN BOTANIC GARDEN

LEAFLETS

SERIES XV BROOKLYN, N. Y., MAY 11, 1927 NO. 4

FAMILIES OF VASCULAR PLANTS
(Except Dicotyledons)

This Leaflet is prepared primarily for classes in the Brooklyn Botanic Garden. It includes the higher plants—clubmosses, ferns and seed-bearing plants—with the exception of dicotyledons, which were taken up in LEAFLET No. 4, Series XII. To the usual characters given, some exceptions occur. A few important exotic families are mentioned in parentheses. The first figure after the family name is the number of genera wild in New York State, the second the number of genera in the world.

CLUBMOSSES, etc. (LYCOPSIDA)

Fibro-vascular tissue continuous; leaves small or narrow, a single sporecase or a few, axillary, above the leaves.

Stem not jointed or grooved, leaves spirally arranged.

Spores of one kind.

(PSILOTACEAE—PSILOTUM FAMILY; 0 of 2: tropical plants, perhaps suggestive of the most primitive vascular plants.)

LYCOPODIACEAE—CLUBMOSS FAMILY; 1 of 2: low, moss-like plants.

Spores of two kinds.

SELAGINELLACEAE—SELAGINELLA FAMILY; 1 of 1: small, branching plants with minute leaves.

ISOETACEAE—QUILLWORT FAMILY; 1 of 1: Grasslike plants growing in water or mud.

Stem conspicuously jointed and grooved, leaves in whorls.

EQUISETACEAE—HORSETAIL FAMILY; 1 of 1: rushlike plants with toothed sheaths at joints, sporecases on cone-like spikes.

FERNS (FILICES)

Fibro-vascular tissue with leaf gap, sporecases numerous, on dorsal (under) side of usually large leaves.

Eusporangiate: sporecases developing from the main portion of fruiting branches.

OPHIOGLOSSACEAE— Adderstongue Family; 2 of 3: leaf base sheathing: grape fern, rattlesnake fern.

Leptosporangiate: sporecases developing from superficial cell.

Spores of one kind

OSMUNDACEAE—Royal Fern Family; 1 of 3: sporecases globose, naked: interrupted fern, cinnamon fern.

SCHIZAEACEAE—Curly Grass Family; 1 of 4: sporecases in double rows.

HYMENOPHYLLACEAE—Filmy Fern Family; 1 of 2: spore case on slender column fronds delicate, pellucid.

POLYPODIACEAE—Polypody Family; 19 of 111: sporecases collected in sori, usually with a cover called indusium: brake fern, maidenhair, ostrich fern, sensitive fern, shield fern, spleenwort.

Spores of two kinds

MARSILEACEAE—Water Fern Family; 1 of 3: growing in water, leaves with long stems and four leaflets.

SALVINIACEAE—Floating Fern Family; 1 of 2: small free floating plants, leaves two-ranked.

GYMNOSPERMS

Carpels open, pollen falling directly on ovule.

Sperms with motile cilia (as in ferns and lower plants).

(CYCADACEAE—Cycad Family; 0 of 9: tropical palm like trees, usually with pinnate leaves.)

(GINKGOACEAE— Ginkgo Family; 0 of 1: seed solitary, leaves fan shaped.)

Sperms not motile (as in angiosperms).

TAXACEAE—Yew Family; 1 of 9: seed solitary, partly enclosed in pulpy aril.

PINACEAE—Pine Family; 4 of 14: leaves alternate, needle-like; seeds in cones: larch, spruce, fir, hemlock.

CUPRESSACEAE—Cypress Family; 3 of 9: leaves opposite or whorled, usually scale-like; seeds in woody or fleshy cones: arbor-vitae, white cedar, juniper, red cedar.

ANGIOSPERMS (FLOWERING PLANTS)

Carpels form closed ovary, tip of carpels modified to form stigma.

DICOTYLEDONS

Fibro-vascular bundles outside of pith, leaves net-veined, floral parts mostly in five's or four's, cotyledons two.

For families of dicotyledons see Brooklyn Botanic Garden Leaflet No. 4, Series XII.

MONOCOTYLEDONS

Fibro-vascular bundles scattered in pith, leaves mostly parallel veined, floral parts mostly in 3's, cotyledon one.

A - D Petals mostly absent or inconspicuous.

A—Mostly Tropical Trees (Palm)

(PALMAE—Palm Family; 0 of 150: coconut, date.)

B—Water Plants (Pondweed)

Or only flowers sometimes raised above water.

LEMNACEAE—Duckweed Family; 3 of 3: Small, free floating plants: duckweed.

NAIADACEAE—Pondweed Family; 1 of 1: stems jointed and leafy.

ALISMACEAE—Water-Plantain Family; 4 of 11; 3 green sepals, often 3 white petals.

VALLISNERIACEAE—Tape-Grass Family; 2 of 14: ovary inferior.

C—Marsh Plants (Jack-in-the-Pulpit)

Or water plants with parts of stem or leaves raised above water.

TYPHACEAE—Cat-tail Family; 1 of 1: flowers monoecious on spadix.

SPARGANIACEAE—Bur-reed Family; 1 of 1: flowers monoecious in globular heads.

ARACEAE—Arum Family; 7 of 110: flowers on spadix: Jack-in-the-pulpit, sweet flag, skunk cabbage, calla.

JUNCAGINACEAE—Arrowgrass Family; 2 of 4: leaf cross-section round, no blade.

ERIOCAULACEAE—Pipewort Family; 1 of 6: leaves grass-like, flowers in heads, perianth chaffy.

XYRIDACEAE—Yellow-Eyed-Grass Family; 1 of 2: leaves narrow, flowers in heads, corolla colored.

D—Grass-like Plants (Grass)

JUNCACEAE—Rush Family; 2 of 8: six-parted perianth.

CYPERACEAE—Sedge Family; 17 of 76: stems mostly solid, leaves 3-ranked, with closed sheaths: carex, bulrush.

GRAMINEAE—Grass Family; 72 of 350: stems, usually hollow, leaves two-ranked, mostly with open sheaths: wheat, corn, rye, barley, oats, rice, sugar cane, bamboo.

E—Ovary Superior (Lily)

COMMELINACEAE—Spiderwort Family; 2 of 27: stems jointed: day flower.

PONTEDERIACEAE—Pickerel Weed Family; 3 of 6: perianth tubular, six-lobed, somewhat irregular: pickerel weed.

(BROMELIACEAE—Pineapple Family; 0 of 53: stamens 6, American plants, mostly tropical: Spanish moss.)

LILIACEAE—Lily Family; 7 of 216: flowers regular, perianth usually of two similar whorls: smilax, trillium, Solomon-seal, asparagus, onion, leek, hyacinth, lily-of-the-valley.

F—Ovary Inferior, Flower Regular (Narcissus)

HAEMODORACEAE—Bloodwort Family; 1 of 9: perianth woolly.

DIOSCOREACEAE—Yam Family; 1 of 9: twining herbs with net-veined leaves.

AMARYLLIDACEAE—Amaryllis Family; 4 of 80: leaves flat from the root, flowers on scape, stamens six, anthers introrse: narcissus.

IRIDACEAE—Iris Family; 3 of 59: leaves two-ranked, equitant, stamens three, anthers extrorse: blue-eyed grass, crocus, gladiolus.

G—Ovary Inferior, Flower Irregular (Orchid)

(MUSACEAE—Banana Family; 0 of 6: large herbs, stamens 6: Manila hemp.)

(MARANTACEAE—Arrowroot Family; 0 of 12: fertile stamen 1, others sterile.)

(CANNACEAE—Canna Family; 0 of 1: stamen 1, anther one-celled.)

(ZINGIBERACEAE—Ginger Family; 0 of 39: stamen 1, anther two-celled: cardamon.)

ORCHIDACEAE—Orchid Family; 15 of 500: stamens 1 or 2, attached to pistil, seeds numerous, very small: vanilla.

Alfred Gundersen.

BROOKLYN BOTANIC GARDEN THIRTEENTH ANNUAL SPRING INSPECTION[1]

May 10, 1927

EXHIBIT OF LIVING PLANTS AND OTHER MATERIAL ILLUSTRATING VARIOUS PHASES OF RESEARCH AT THE BROOKLYN BOTANIC GARDEN

Beardless Iris

Classification of Flowering Plants

Experimental Evolution

Evolution in the Boston Fern

Flora of Long Island

Forest Pathology

Genetics and Plant Breeding

Plant Pathology

Vegetation of Long Island

together with the
Research Publications of the Members of the Staff

---

[1]BROOKLYN BOTANIC GARDEN LEAFLETS

Series XV Brooklyn, N.Y., May 18, 1927 Nos. 5 - 7

BEARDLESS IRIS

GEORGE M. REED AND MONTAGUE FREE

The Beardless Iris project is being carried out in cooperation with the American Iris Society. One problem is the investigation of the conditions favorable for culture, including a study of soil, fertilizers, time for transplanting, and diseases. Experimental beds bearing upon some of these questions have been started in the Experimental Field. A second problem is concerned with the proper identification of varieties, their accurate description and classification. As a part of this study, Miss Maud H. Purdy is making water-color illustrations of typical varieties.

A few of Miss Purdy's studies in water-colors, of the Japanese and other Beardless Iris, are placed on exhibition.

CLASSIFICATION OF FLOWERING PLANTS

ALFRED GUNDERSEN

A. Systems of Classification

Since so many different kinds of plants are known, we must have some method of classifying them. The exhibit shows three groups, each with the same twenty plants; each plant represents a family. The arrangement in each case is according to a famous system of plant classification.

1. Arrangement according to *Jussieu, Paris, 1789,* in *Genera Plantarum Secundum Ordines Naturales Disposita.* The printing of this book was completed July 13, the day before the fall of the Bastile, and the work was considered as a product of the revolution.

2. Arrangement according to *Bentham and Hooker, Kew, 1862-83,* in *Genera Plantarum*—"the greater portion," according to Hooker, "the product of Bentham's indefatigable industry."

3. Arrangement according to *Engler, Berlin, 1889-1900,* in *Die Natürlichen Pflanzenfamilien* after thirty years, though now unsatisfactory in details, still the most complete exposition of the plants of the world considered as a whole.

B. The Frankeniaceae as a Link in the Classification of Dicotyledons

Bentham and Hooker, following earlier botanists, placed the Pink Family near the Frankenias and St. John's Worts.

Engler placed the Pink Family near the Goosefoot Family.

If both of the connections are real relationships, important rearrangements of the families of dicotyledons would follow.

The exhibit shows specimens, drawings and maps of distribution of Frankenias and other families.

The diagrams indicate forms of placentation, that is, the method of attachment of the ovules in the ovary.

EVOLUTION IN THE BOSTON FERN

RALPH C. BENEDICT

In the field of experimental organic evolution, the crucial problem may still be most succinctly expressed in the phrase which Charles Darwin made classical as the title of his epoch-making book, nearly seventy years ago, "The origin of species." Is there historical or experimental evidence of the origin of new species today? Has anyone recorded or watched the progress of development of a new form of plant or animal which may be called a "new species"?

The difficulty in reaching general agreement regarding the validity of the evidence of the actual appearance of new species rests chiefly in the definition of the word "species," and this difficulty has formed the basis for hundreds of pages of scientific discussion. For practical purposes, leaving technicalities aside, we may set down two criteria of a species which must be included in any accurate definition of the term.

(a) A species consists of all the individuals which resemble each other closely, and which differ distinctly from other similar groups.

(b) The individuals of a species must "breed true," i.e., produce progeny like themselves, or at least, varying only within the limits of the whole population of the species.

As a corollary to any concept of the word species, the origin of a *new* species according to organic evolution must proceed by *variation;* the production of progeny markedly distinct in characteristics from the parent forms, and capable of reproducing the new type; i.e., of breeding true.

In consideration of the origin of species, there are offered in this exhibit three series of plants representing species and varieties of the fern genus, *Nephrolepis,* which has been under experimental culture for over thirteen years here at the Garden. These series may be designated as follows:

Series I. A set of recognized taxonomic species, as obtained from tropical regions where *Nephrolepis* is native, both American and Old World.

Note the differences which obtain in size, color, habit and cutting of the leaves, and the more technical differences in the reproductive bodies on the backs of the leaves, and in the scaly investiture.

Series II. A set of the bud sports, i.e., horticultural varieties, introduced by florists during the last thirty years. A representation of most of the named American varieties is given on the chart shown on the wall. All these varieties and many more have been developed by variation from one original form, the so-called Boston

Fern, in less than thirty years. Note for comparison with the taxonomic series the differences in size, form, color, and cutting of leaves.

Series III. A set of new types raised at the Garden from the only known spore-fertile variety of Boston Fern. Over one hundred different forms have been raised in this sporeling series within the last ten years, and that number might have been much larger if space had been available for their propagation and culture. Compare also the leaf differences, etc., of this group.

The chief taxonomic basis for the distinction of "species" is found in anatomical differences. In this connection it is noteworthy that the two series of experimental varieties offer a wider range of morphological distinctions than exist in the whole range of the wild forms of *Nephrolepis*. It may be noted also, that in general, the horticultural and experimental varieties of this fern genus breed true, thus fulfilling another of the qualifications of specific distinction given above.

EXPERIMENTAL EVOLUTION

C. Stuart Gager

Alteration of Heredity by Experimental Treatment

It is generally accepted by modern students of heredity that transmission is accomplished by definite bodies in the nuclei of sperm- and egg-cells. These bodies, since they readily stain with dyes, are called *chromosomes*. The hereditary factors carried in the chromosomes are called *genes*.

It has been found by experiment that living matter may be altered by exposure to radium rays. Theoretically, if germ-cells (sperm- or egg-cells) are exposed to these rays, the chromosomes or genes should be affected, and this should alter one or more of the characters of the plant (or animal) that develops from the exposed germ-cells.

The plants in this exhibit are a normal plant of the Jimson Weed or Thorn Apple (*Datura Stramonium*), and another plant derived from seed of a pedigreed normal plant whose egg-cells had been exposed to radium rays. On account of the unusual thickness of the brittle stems, the abnormal type is called *Swollen*.

It seems reasonable to conclude that the alteration of the adult characters is a direct result of the exposure of the germ-cells to radium rays, for the character *Swollen* has never before appeared in many generations of pedigreed stock of this plant. If this conclusion is valid, this would appear to be the first on record of altering inheritance by exposing germ-cells to radium rays.

There is also exhibited one of the tiny capillary tubes that contains the emanation or radioactive gas given off by radium, which was the source of the rays used in these experiments.

FLORA OF LONG ISLAND

NORMAN TAYLOR

There are 1,953 species of flowering plants and ferns known to grow on Long Island, without cultivation. Of these, about 1,453 are native American plants, and about 500 have been introduced.

For all the native sorts, card maps are kept, upon which, for each species, all the data of their Long Island distribution are recorded. These, in a few years, will serve as the basis for a "Flora of Long Island." It is obviously impossible to show all these maps, and copies are shown only for those few wild flowers gathered yesterday.

An herbariam of twenty thousand specimens is maintained at the Garden as a record of the distribution of Long Island species.

FOREST PATHOLOGY

ARTHUR H. GRAVES

Research in Forest Pathology at the Brooklyn Botanic Garden is being carried on in the field of Fungous Diseases of North American Trees. Exhibits are shown here of:

I. THE CHESTNUT BARK DISEASE. This is the devastating plague which has nearly wiped out the native Chestnut in North America. The disease, first noticed in 1904, was brought into this country about 1890 on imported Chestnuts from Japan or China, where it has long been known. It is caused by a parasitic fungus which grows in the healthy bark, gaining its entrance through wounds in the trunk or branches. Millions of spores are produced from every diseased patch of bark, and these are carried by various agencies—wind, birds, etc., to healthy trees. The growth of the fungus in the living bark, by continually increasing the radius of its activities, finally girdles the trunk or branch, thus killing it.

Investigations in this disease are being directed along three main lines:

1. *A study of the causes of disease resistance.*
2. *The development of resistant stock by breeding.*
3. *Search for wild resistant individuals.*

II. THE NECTRIA CANKER. A serious fungous disease of Birches, on which investigations are now under way.

III. THE BUTTERNUT BLIGHT. A destructive disease of the Butternut, the nature and recommendations for the control of which have been worked out here at the Garden.

IV. To show the nature of fungous diseases in timber, exhibits of well known diseases of Ash, Pine, etc., are shown.

GENETICS AND PLANT BREEDING

ORLAND E. WHITE

In 1865, after experimenting for over eight years, principally with garden peas, Gregor Johann Mendel discovered the key to our modern understanding of heredity: His two generalizations, now known as Mendel's laws, are regarded as the first real steps in the foundation of the modern science of genetics.

This exhibit shows pictures of Mendel, and the garden at Brünn, Czechoslovakia, in which he is said to have conducted his experiments.

The exhibit of peas shows many of the characters that strikingly differentiate one variety from another. Over 120 characters in peas have been studied experimentally, and the manner of their inheritance determined, as well as their relation to each other and to various environments. In their inheritance, these characters illustrate Mendel's laws, as well as other laws of heredity discovered since. Peas, as well as other plants, and animals including man, appear to be composed of hereditary units or character determiners, called factors. Combinations of these units determine the hereditary character of the plant or animal, as the letters of the alphabet make up a word. Change a single letter in a word such as freeze to frieze, and the word becomes something entirely different. Substitute one of these hereditary units for another in an organism by crossing, and it, too, becomes something different—a new variety. By suitable combinations of these hundred or more characters in peas thousands of new combinations or varieties can be produced, just as the twenty-six letters of our alphabet can be combined to produce thousands and thousands of different words. Some of these new pea combinations may differ from each other by one hereditary unit, others by two, three, fifteen, or more. The exhibit illustrates plants differing in one, two and more characters. Practically any combination we want, we can obtain, given sufficient length of time.

But the most *interesting* fact about these hereditary units of plants and animals is that they appear to be partially linked together in groups, and that the groups correspond in number to the pairs of little rod or bead-like bodies in the cells of plants and animals called *chromosomes*. In peas, there are seven pairs, and our experiments in the field and greenhouse plots, involving hundreds of crosses and thousands of pedigreed plants, are designed to shed more light on this intricate subject. Chromosomes are believed to be the carriers of the hereditary units. Hence they represent the most important part of an animal or plant.

The other material illustrates the results of making certain crosses showing the types of offspring that were secured in the first and second generations from such unions.

For example, the corn or maize shows the two actual parent varieties. The mother was a Pueblo Indian corn with large ears,

and large, rounded, non-popping, black and bright red seeds. The father was a pop corn with very small ears, and small, pointed, light yellow seeds. The first generation ears are practically all alike. The second generation, grown from seeds of these first generation plants, exhibit an enormous and striking diversity, with types similar to the parent and the two grandparents, and many new types. Dozens of new varieties could be obtained by further breeding from this single cross.

The castor oil bean material exhibited illustrates the inheritance of size and color patterns in the first and second hybrid generations.

PLANT PATHOLOGY

George M. Reed

The research in plant pathology at the Brooklyn Botanic Garden is concerned mainly with the general problem of disease resistance in plants. The studies include the determination of the presence or absence of resistance in particular hosts to certain parasites; the influence of external conditions upon resistance and susceptibility; the occurrence of possible physiologic races of parasites; and the inheritance of disease resistance. Suitable material for the study of these problems is afforded by the cereals, and the cereal smuts which parasitize them. Many varieties of wheat, oats, barley, rye, corn and sorghum have been developed in various parts of the world; they are very prolific annual plants, producing an abundance of seed; they also harbor several virulent smut fungi, no less than four on wheat, two on oats, three on barley, three on rye, two on corn, and five on sorghum.

The exhibit includes the following features:

1. Sorghums and sorghum smuts.

A. Sorghum varieties: A collection of Kaoliangs from Manchuria, Sorghums from India, and Feterita, Kafirs and Sorgos, which originally came from Africa.

B. Sorghum smuts: Specimens of the covered and loose kernel smut and the head smut.

C. Sorghum hybrids: The parents, first, second and third generations of crosses between resistant and susceptible varieties.

2. Oats and oat smut.

A. Types of oats, including black, red and white hulled varieties, and a hull-less type.

B. The harvest from one badly smutted row.

C. Thirty-eight grandchildren of resistant and susceptible parents inoculated with covered smut, some being infected and the others not.

D. Seed samples of second generation plants showing the inheritance of the black and white glume color.

3. Wheat and barley. Specimens of normal and smutted wheat and barley plants.

4. Corn. Specimens of normal and smutted ears.

THE VEGETATION OF LONG ISLAND

NORMAN TAYLOR

This study, as the wall chart indicates, has two main objectives, —the vegetation itself, and the environment and how plants respond to it.

1. The vegetation has been mapped as to types, of which there are several on the island. Perhaps the most noticeable, the great central pine-barren region (red on the map) has changed little from the day when General Washington rode through it, and wrote (22 April 1790) it "is too poor to admit inhabitants or cultivation, being a low scrubby oak, not more than two feet high, intermixed with small and ill-thriven pines." Other types of vegetation are the grasslands at Montauk, Shinnecock, and the Hempstead Plains; and the richer types of forest along the north shore.

So far as the vegetation itself is concerned, the study comprises such questions as (*a*) : rates of growth of different tree species on the different soil types; (*b*) the succession or march of vegetative history from a simple treeless condition through the intermediate stages to the vegetative climax of the area, or what is known as PLANT SUCCESSION; (*c*) fire and its effects upon vegetation and the site; (*d*) the indicator significance of wild vegetation as to agricultural possibilities on Long Island. This study of the vegetation is known as PHYSIOGRAPHIC ECOLOGY.

2. The study of the environment and how plants respond to it, is naturally much broader in its aspects than the study of the vegetation itself,—in fact Long Island vegetation is here considered merely as illustrative material for problems of plant research. This type of work deals in the main, excluding many minor aspects of it, with

(*a*) Atmospheric environment: represented by the wind gauge (and fan to run it), the plant within its influence; a set of evaporimeters for measuring the totality of atmospheric influences upon plant life; soil temperature which reflects rather accurately the mean air temperature of the island. These and other experiments too complicated to set up here have been accomplished, or are contemplated on Long Island.

(*b*) Soil environment: studied from three angles

1. Soil acidity or alkalinity, which are determined by the potentiometer and colorimetric method.
2. Soil fertility. More than seventy Long Island soils have been studied to determine the available nitrogen and its effects upon the vegetation. (See photograph of these experiments.)
3. Physical characteristics. Measured by growing plants in sealed containers, and determining the wilting point of the different soils. (See plants in aluminum cans; 1 set still vigorous, the other wilted.)

This study of environmental conditions is, speaking generally, known as PHYSIOLOGICAL PLANT ECOLOGY.

BROOKLYN BOTANIC GARDEN

LEAFLETS

SERIES XV BROOKLYN, N. Y., JUNE 8, 1927 NOS. 8-10

OUR COMMON GARDEN VEGETABLES

THEIR HISTORY AND THEIR ORIGIN*

When buying the day's vegetables or planting a garden to raise a year's supply, did you ever consider how man came to grow these particular plants—celery, potatoes, radishes, beets, etc., instead of hundreds of others that might possibly have been just as tasty and productive? Have you ever seen the wild ancestors of some of our most palatable vegetables? And if so, did you recognize them as such? As an explorer in search of new and valuable food possibilities, would it occur to you to "try out" the weedy wild carrot, wild parsnip and wild lettuce of the vacant lots and uncultivated fields? Do you realize how strange the vegetable marts of Europe previous to the discovery of America would have looked to you? There would have been no string beans, no lima beans, no potatoes, sweet or Irish, no corn, no pumpkins, vegetable marrows or squashes, no peppers and no tomatoes; for these are all native to America. Did you know that all the cabbage tribe, the cresses, turnips, carrots, beets, and many others now commonly grown about New York City, were immigrants like ourselves, many of them having journeyed from the East Indies, Central Africa, Northern Asia and far New Zealand? And if you should talk to the men in charge of introducing new plants—the agricultural officials of our federal and state experiment stations, and the collectors for the big seed companies —they would tell you the earth is still being ransacked for new things to eat in the vegetable line. They could tell you the vegetable ingredients of "chow main" and "chop suey," of how cheaply and efficiently the Chinese and the inhabitants of other densely populated regions live, practically without the use of meat. They could tell you of giant winter radishes (40-50 lbs. in weight) from Japan, of oriental beans that produce twice the quantity per acre that ours do, of muskmelons that keep for months, and various other queer wares of the green-grocer. And if you go to your local botanist, he can tell you of lamb's quarter, of wild mustard, of pokeweed and other weeds and wild plants that grow in profusion about you and go to waste every year for want of picking, while you buy laboriously raised spinach—neither as fresh nor as cheap as these "weed" greens. The origin and world-

* This LEAFLET is a reprint, with revision and additions, of Series VI, No. 3, 1918.

wide distribution of our common vegetables is a history of famines, of explorations, of changing tastes, of dire necessities, and of awakened curiosities. It is a history of a few men battling against a people's age-long habits and prejudices in order that these people might live better. It takes fifty years to introduce a new vegetable into India, writes one authority. And it is the worst thing we are up against—this prejudice against new things—remarks one of our own agricultural officials. But to return to our subject—the vegetables we usually style American are largely gifts or heirlooms from the ancient Indian civilizations of Peru and Mexico—relics of the long vanquished empires of the Aztecs and the Incas.

Corn, for example, is supposed to have arisen ancestrally somewhere in the plateau region of southern Mexico or of northern South America. When the white race first came in contact with it, the Indians had distributed it far and wide over both continents of the New World—from Argentina to southern Canada, from ocean to ocean. Vast fields of this grain were traversed by the Spaniards in their pioneer marches and explorations in what are now the states of Florida, Alabama and Mississippi. Even those Norsemen that history vaguely affirms landed in this country about 1002 A. D., were said to have seen a wicker or log crib for corn. Columbus, writing in 1498 to his patron king and queen, speaks of passing through 18 miles of cornfields. Over 7,000,000 bushels were bought annually for the Mexican palace of the Aztec rulers. A French military expedition against the Seneca Indians in 1685 spent ten days burning what was computed to be 1,200,000 bushels of corn. As to varieties, they were as varied in texture, size of grain and ear, time of maturity, and as kaleidoscopic in color as they are to-day. No "wizard" white man can claim credit for "creating" sweet corn, flint corn, pop corn, dent corn and the various other types—for these were known and cultivated by the Indians long before his coming. In fact, the first sweet corn raised by the white man was obtained from the Susquehanna Indians in 1779 and grown around Plymouth, Massachusetts. In 1854 there were only a few varieties known, perhaps not more than two. The hundred or more varieties obtained since then have largely resulted from either accidental or artificial hybridization or crossing with pop and field corn. The proper name of corn is maize, derived from the Haytian Indian word "Mahiz" applied to the same plant. Corn is an old world term for grain, especially wheat, and brings confusion when applied to maize. Wild maize is unknown and many botanists suppose it resulted from chance hybridization between a closely related plant called teosinte and some other unknown grass. Others are inclined to look upon pod maize as either the wild plant or somewhat similar to it. In many European countries ears of maize are so little known as to be objects of great curiosity. Likewise, popcorn, until very recently, was very rarely seen in Germany.

Wild potatoes of a large number of species are common in many parts of the Andean and Mexican plateaus as well as in the fog-embowered islands of the Chilean Archipelago. One wild variety flourishes as far north as southern Colorado, but this form has not contributed anything to present-day potato growing, except the "potato-bugs," for which it,

together with other Solanaceous plants, long furnished a comfortable and acceptable home. Another species, *S. Commersoni,* now attracting attention in Europe, is native to dry, rocky situations in Uruguay and Argentina. *Solanum tuberosum,* as the wild form of the common potato is called, is common in Chile and perhaps in other parts of the South American west coast region, where it to-day flourishes in as many varieties, though not in as desirable ones, as there are or ever have been in cultivation. According to DeCandolle and others, the potato has been cultivated in Peru for two thousand years or more, and it was from near Quito, Ecuador, in the forepart of the sixteenth century, that the Spaniards first brought it to Spain. From there it was taken to Italy and then to Belgium and France. So far as history tells us, the North American Indians did not cultivate it nor did the highly civilized Aztecs of Mexico. Potatoes were introduced into Ireland before 1663, but not by Sir Walter Raleigh or from the North American colonies as commonly stated. The Irish planted them everywhere and used them as a commissary in maintaining their opposition to English rule and this gave them the now widely used English name of "Irish potatoes." Europe as a whole did not "fall in love at first sight" with the potato, and as late as 1771, only a few varieties were listed in the English catalogs. Frequent famines caused the Irish to appreciate its good qualities, while grain crop failures and attendant evils brought them into similar esteem as a field crop in Germany about 1772. The Presbyterian immigrants from Ireland introduced the potato to the New England colonists in 1718, although it is said to have been served at a Harvard dinner in 1707 as a great and rare delicacy. The Peruvian Indians prepare by freezing and drying potatoes a product called "chunyo" which can be safely and easily stored during the Andean high-altitude winters. One of the early English herbalists mentions them as a delicacy and "no common food." According to Safford, when potatoes were first introduced into Scotland, the zealous Presbyterians looked at them askance, declaring they are not mentioned in the Bible, and it was hunger that finally drove them to appreciate their good qualities. In 1914, in France, occurred a unique exhibition, commemorating the work of Parmentier in popularizing the potato among the French, and recalling the difficulties often experienced in changing a people's food habits. Prominent Frenchmen, as well as Englishmen, had tried various expedients, such as "society dinners," etc., to popularize the potato, but their efforts were of little avail. Parmentier's attention to the value of potatoes as food came about through noticing the soldiers dig them up and roast them over the camp fire during the terrible Seven Years' War, when food was extremely scarce. His investigations led him to devote his life toward popularizing them. He, like others, inaugurated potato feasts, the result of which made him so unpopular that he failed to be elected to a desired government office, the people fearing he would force them to live entirely on potatoes. Finally, he hit upon a successful scheme, based on the principle that "stolen sweets are sweeter." The king annually held a military review near Paris, on a piece of ground noted for its extremely poor soil. The day after the review, Parmentier planted this land to two kinds of potatoes, one of which it was said "would grow in powdered glass." The

Parisian crowd looked on in amused contempt, which later turned to stupified astonishment, when they gathered to witness the harvest. During the day when the potatoes were being dug, the immense crowd was kept back and the potatoes guarded by soldiers, but these guards were removed at night to encourage stealing. The yield was nine-fold, even under such unfavorable conditions—not counting those stolen, which no doubt must have been considerable. On Parmentier's grave, potatoes are said to blossom each year.

In 1882, the weekly consumption of potatoes in London amounted to 500 tons, and the quantity sold in its streets between September and April through the "baked potato hawker's" cry of "Warm your hands and fill your belly for a ha' penny" was estimated at 60 tons weekly. To-day, the world's crop is over five billion bushels, and they are grown in and known to almost every country on the globe. One acre has been known to yield as high as 1,200 bushels, although the average for the most favorable potato countries lies between 150-210 bushels per acre. One acre of potatoes often supplies as much food as ten acres of wheat.

As second cousins of the potato, we have tomatoes, red peppers and the egg-plant. The first of these is regarded as a form of the wild, small-fruited tomato of Peru, similar in many respects to our present-day plum and cherry tomatoes. So far as our records go, many forms of this species were introduced into America and Europe, and the tomato, as with many other cultivated plants, probably owes much of its great diversity in kinds to a large number of wild forms belonging to one variable species, the characters of which have been shuffled and combined by artificial and natural crossing. It is extremely doubtful if the ancient Peruvians appreciated the good qualities of this plant enough to extensively cultivate it. And it is certain that less than a hundred years ago, even Americans looked with suspicion upon it as the cause of various ills, such as cancer, and grew it largely for ornament instead of food. There were several types of these "love apples" as they were called in those days, all of which were comparatively small fruited (2.5 inches in diameter), except one form called "Large Red," which sometimes produced fruits over 4 inches through. These large fruits were somewhat ribbed and angular, but on the whole, fairly smooth. Then appeared a giant fruited form of this, evidently a monstrous or fasciated condition, so far as the fruit and blossom was concerned. The fruits often weighed 4 pounds, and sometimes even over 5 pounds, but they were deeply ribbed, corrugated, and almost anything but smooth. Through the efforts of various seedsmen and especially those of the pioneer scientific farmer and one time street commissioneer of New York City, Colonel Waring, tomato varieties with smooth skins, solid flesh and of large size, were obtained by crossing the small, smooth, watery, seedy types with these large fruited forms. One of these was the Trophy, which is said to have been an epoch maker in commercial tomato growing. Seeds of the Trophy, first distributed in 1870, were sold for five dollars per packet of 20 seeds, single seeds commanding 25 cents each. Tomatoes of perfect shape and smoothness weighing almost a pound and a half were obtained from this variety. Tomatoes were first used commonly for food

in Italy, then in France and England. They were introduced into England as early as 1596. An eighteenth century English gardener writes about them, together with egg plants, as great curiosities for the garden. An English herbalist says tomatoes were used in hot countries "to cool and quench the heat and thirst in their hot stomaches." The first tomato was commercially canned in 1847. The average yield of salable fruit for the United States is probably around 6,000 pounds per acre, but a not at all exceptional yield is 30,000 to 40,000 pounds. Over 500 varieties of tomatoes are known to the American trade at present, whereas fifty years ago there were a dozen or so.

Red peppers were as popular as a food condiment among the ancient inhabitants of the Americas as they are to-day among their descendants in Mexico and the Andean highlands in the form of Chili con carne, hot tamales and other mouth-burning food preparations. Toward the end of the sixteenth century, European physicians regarded red peppers as a cure-all for various ills, such as dropsy, colic, ague, tooth-ache, quinsy, tropical fevers, gout, paralysis and many others—a sort of primitive "Peruna." At this period, the "dietitians" believed red peppers aided digestion, instead of the opposite as now. Thus the fashions change. According to various authorities, tropical South America, especially Brazil, was the original home of the various species or forms which through crossing and natural variation, have given us our present varieties, some thirty of which are rather common.

Though closely related botanically to the tomato, potato and pepper, the egg plant is not an American. Its original home is supposed to have been India, where a closely related wild species, *Solanum insanum,* is rather common. The relationship of the egg plant to these three vegetables as well as to tobacco is exemplified by grafting all of them into one plant, the result being a single plant bearing egg plants, tomatoes, tobacco leaves, and potatoes, each after its kind—a startling curiosity perhaps, but not commercially valuable. The egg plant was cultivated in north Africa in the ninth century but was not introduced into England until 1597. In India it is often known as "brinjal" and the natives eat them in curries or roasted in red-hot ashes and mashed with salt, lime juice, onions and chillies. In France they are called "aubergines" and the white fruited varieties are preferred.

Pumpkins, vegetable marrows, and most of the summer squashes are regarded by the botanists who classify plants as forms of one species, *Cucurbita Pepo,* probably native to tropical Africa, though no wild forms are known with certainty. From a geneticist's standpoint it is extremely doubtful that forms with such extremely diverse characters, such as those of the field pumpkin and the Scalloped Bush or Patty Pan summer squashes, belong to the same species or trace their origin back to the same or similar wild ancestors. Both pumpkins and summer squashes, however, appear to have been grown by the Indians in their corn patches all along the Atlantic sea coast when the European colonists landed and settled this section. The island of Nantucket is said to have had a warty variety, which gave rise to our common field pumpkin. During the American Revolution, a crude form

of sugar and a sweet syrup were obtained from these pumpkins and used as sugar substitutes. The first pumpkin pies were very different preparations from those of to-day. They were made by cutting a hole in the side of a pumpkin, extracting the seeds and fibrous matter, stuffing the cavity with a mixture of apples, spices, sugar and milk, then baking the whole, and this, says an old chronicler, "is commonly called pumpkin pie." Pumpkins are grown in all warm and temperate countries now, the crop yielding from 8-15 tons per acre, and being most esteemed for fall stock food, Jack o' Lanterns and Hallowe'en festivities.

Winter squashes, among which are included some types with fruits very much resembling pumpkins in both shape and color, belong to two species, *Cucurbita moschata* and *C. maxima,* both of which have not been definitely allied with wild species. Hence their native country is unknown, though the bulk of the evidence points to tropical South America, especially the west coast, as the home of *C. maxima.* Some botanists believe the other species to be from southeastern Asia, but the presence of an allied wild species in Uruguay and perhaps elsewhere in America, makes this doubtful. The seeds of both these species apparently have been found in the ancient Peruvian tombs of Ancon near Lima. Neither pumpkins nor squashes, so far as we can learn, were known or at least common in Europe before the discovery of America, but they became plentiful a century or so later. The Hubbard, Autumnal Marrow (Boston Marrow), Mammoth, and others belong to *C. maxima.* Some varieties such as Mammoth, Chili, Valparaiso and others were introduced directly from western South America, while the Hubbard, introduced in 1857, was probably brought from the West Indies. Some varieties of this species bear the largest fruits known, and these are very often called pumpkins. At country fairs specimens are sometimes seen weighing 200 to 300 or more pounds and of sufficient size to literally house "Peter Pumpkin Eater's Wife," provided she was a small sized woman.

The old time Winter Crookneck is supposed to be a form of *C. moschata,* and a very similar variety has been obtained from the Seminole Indians of Florida who have grown it from time immemorial, supposedly. This, if true, is another link in the chain that points to America, and not Asia, as the original home of this species, unless it was introduced by Asian visitors previous to the white man's coming. In India, the natives grow pumpkins and squashes, as well as various gourds, over their houses.

The Cucumber is undoubtedly native in India, where a wild representative, *Cucumis Hardwickii* Royle, is still quite common. Western Asia and India have probably cultivated the cucumber for over 3,000 years, and its introduction into China took place in the second century B.C., when a Chinese ambassador returned from a mission to western Asia. In ancient times, as now, immense quantities of this vegetable, as well as various melons, were grown in the "Near East"—in Syria, Persia, Russian Turkestan, and the Caucasus. The Egyptians are also supposed to have known the value of this salad vegetable, and in the trek of the Israelites through the wilderness, there were many loud complaints about their manna fare, mixed with such regretful exclamations as "We remember the fish which we did eat freely,

the cucumbers and the melons." In the ancient Hindu chronicles, married women are told to worship the cucumber that they may not lose their husbands. Under the name of *sikuos,* ancient Greece cultivated and partook of the cucumber, while in Rome, the emperor Tiberius so loved this fruit, that he had it grown in boxes on wheels and moved about so as to derive the full benefit of the sun. In winter, they were grown in crude hot-beds. The English were introduced to the cucumber in 1573, and owing largely to the cool climate, they grow peculiar long-fruited greenhouse varieties, quite distinct in flavor from ours. The pickled little spiny gherkins are native to the West Indies and belong to a distinct species, *C. Anguria* L. In many oriental countries, young fruits of melons are used as vegetables. Thus the Hindus prepare a delightful vegetable dish from a two-thirds mature watermelon of a special variety by frying it in butter (ghi) with split gram peas (Turkish peas or garbanzos), and a curry powder made of black pepper, cinnamon, cloves, cardamons, dried coconut, turmeric, salt and asafoetida. This melon is also prepared by boiling well, then adding milk, pepper, salt and nutmeg. Before the advent of pumpkins and our common squashes the Europeans used various gourds, especially the dipper or calabash gourd (*Lagenaria*) as substitutes.

Beans, both dry and green shell, as well as string beans, Lima beans and Scarlet Runner beans are all natives of tropical and sub-tropical America, and both the common bean (*Phascolus vulgaris*) and the Lima (*P. lunatus*) were met with commonly by the Spaniards when they first came in contact with the Indians of Florida, Mexico and Peru. Wild forms of the large Lima bean are known from the upper Amazon River valley and its seeds have also been found in the ancient Ancon tombs of Peru. When America was discovered, historic records indicate that the common bean had been widely distributed among the Indians of both South and North America. In many of the warmer sections of these two continents, the Lima was also well known. In the southwestern desert region of the United States, a distinct species has been cultivated for possibly thousands of years, the Indian traditions indicating that the cliff dwellers and other prehistoric inhabitants, long since vanquished, first gathered it from the nearby canyons and began its cultivation. Over 300,000 bushels of these teparies, as they are called, were raised and marketed in 1917, the white varieties being similar to our small pea bean or navy. Beans first came into general usage in this country during Civil War times. When the soldiers returned home, they retained their liking for them and thus a dependable market was produced. Hundreds of varieties of beans were apparently known to the Indians and now the varieties number thousands, 500 or more of which are of the bush type. This bush type seems to have appeared since the "white man's" coming to America, since the Indian varieties are believed to have been either pole or viny bush types.

The beans of the old world, previous to America's discovery, were the seeds of various legumes, especially those of *Vicia Faba,* known as the broad or Windsor bean, and of certain species of *Dolichos.*

Sweet potatoes are not of African origin, as one might logically suppose from the intimacy that exists between them and our colored population.

Most botanists credit them to tropical America, where a closely allied wild species and possibly the ancestral one, *Ipomoea fastigiata,* is quite common. Sweet potatoes, like the common potato, corn and beans are of extremely ancient cultivation in America, the Spaniards and other early explorers finding them common among the Indian tribes of southern Mexico, the West Indies, Peru, and northern South America. In fact, the name potato rightfully belongs to this form of the morning-glory family, as it, and not the Irish potato, was the common potato of Elizabethan and Shakespearian times, its Spanish name "batatas" being corrupted into the English "potato." Long afterwards the common potato was called "Irish potato," in distinguishing between them. Although introduced to Europeans very soon after the discovery of America, its culture and disssemination was slow, and its popularity in France was increased by the Parisian restauranteurs agreeing as a body to buy and serve it on their tables. A Frenchman remarks that the Empress Josephine, true to her Creole taste, was exceptionally fond of them and increased their popularity by ordering large quantities planted on the French Crown lands. America, however, is still said to be the largest consumer, the estimated crop for 1917 being 87,141,000 bushels, or about one-fifth of the estimated Irish potato crop for the same year. This amount, if rationed out, would allow nearly a bushel to each man, woman and child in our country, but unfortunately storage difficulties are so great that it has been said that for every sweet potato eaten, three rot or are otherwise lost, hence each sweet potato consumer pays for three potatoes he never sees. In the south, certain varieties of sweet potatoes are erroneously called yams, a plant most remotely related to the morning-glory family.

Most of the vegetables so far mentioned have been American in origin, but the great bulk of the green-grocer's wares, so far as diversity is concerned, are natives, like ourselves, of the old world. Of forty-four common market vegetables of New York City, thirty-five are of European, Asiatic or of African origin, while one, the common mushroom, is native to the whole northern hemisphere, though first introduced as an inviting dish by Europeans. If many of the uncommon vegetables of the semi-foreign city markets, such as garbanzos, bamboo sprouts, water chestnuts, and sprouted beans are included, the percentage of old world vegetables is still higher. Of these thirty-five or more kinds, nearly all come from Europe and Asia—a rather strange fact when one considers the luxuriance and diversity of tropical plant life.

In a large number of cases, as you have probably already surmised, these vegetables have been cultivated by man so long that the identification of their wild ancestors is somewhat in the nature of a guess, especially when reliance is placed on character comparisons. For, many of the variations among cultivated plants are so striking that with our commonly accepted notions regarding variability and heredity, it seems almost impossible that such a plant as the common wild cliff cabbage of Europe and Asia could give rise to all our cultivated forms of cabbage. Yet, if this plant is not the ancestor, what plant is? Of all the plants botanists know, it most nearly resembles what they believe that ancestor should look like. Growing on the bleak chalk cliffs of Dover or along the Mediterranean

Fig. 1. A nearly mature plant of wild lettuce, *Lactuca scariola* L.

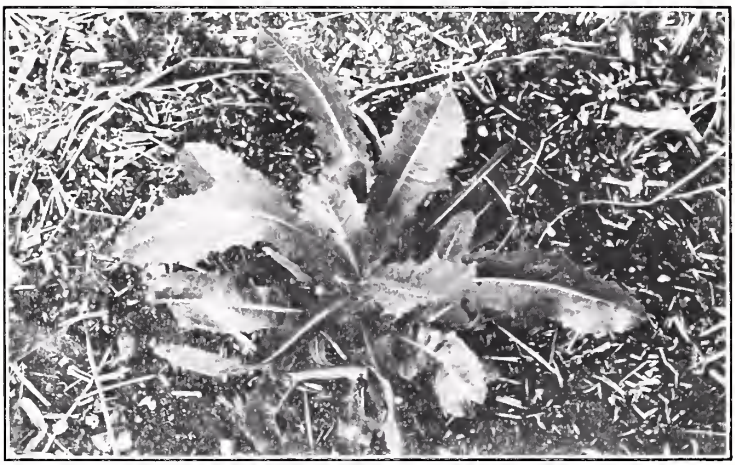
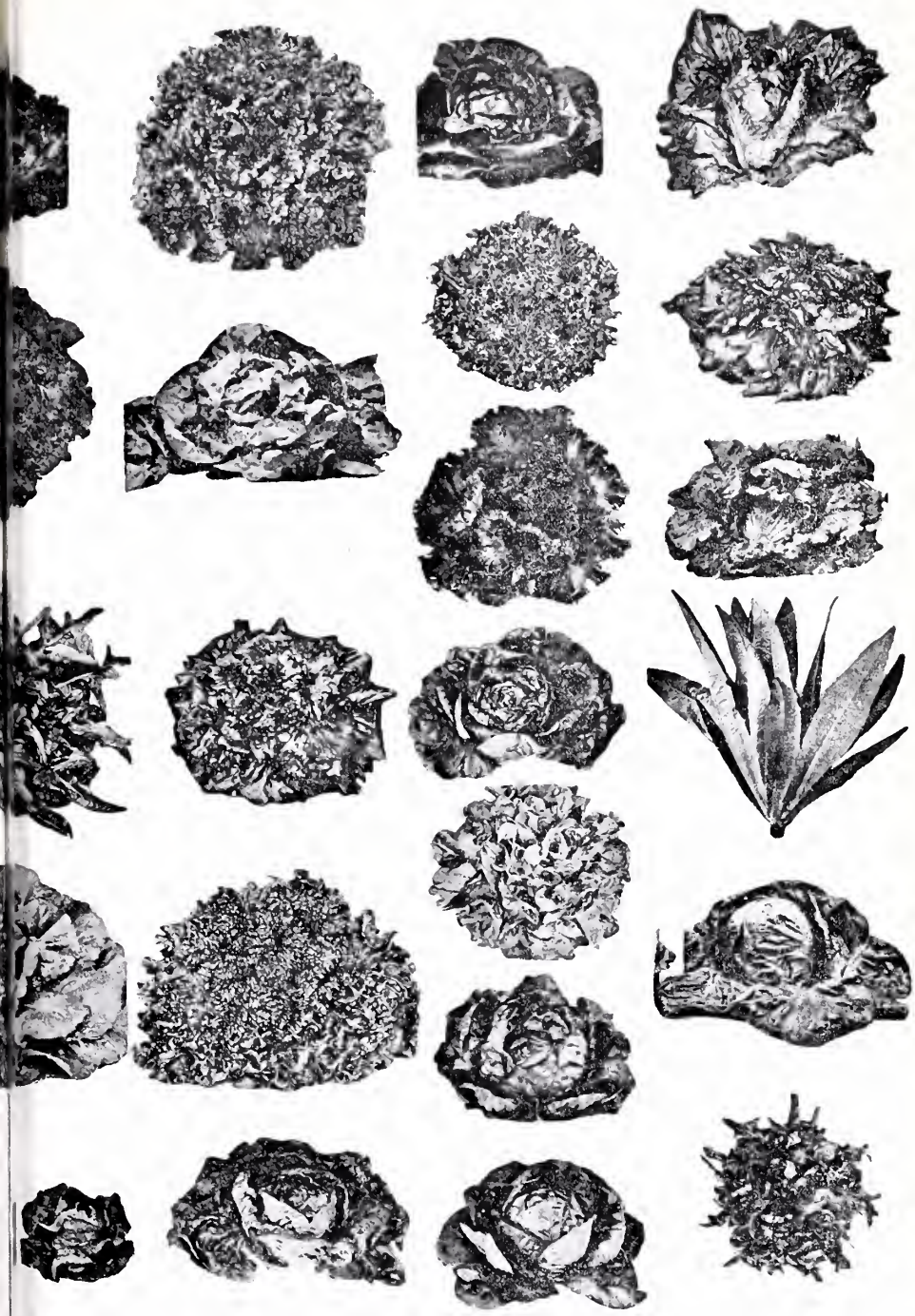


Fig. 2. Wild lettuce in the rosette stage.

Fig. 3. Typical specimens in the rosette stage of 42 varieties of cultivated



tuce, *Lactuca sativa* L. (After W. W. Tracy, U. S. Dept. of Agriculture.)

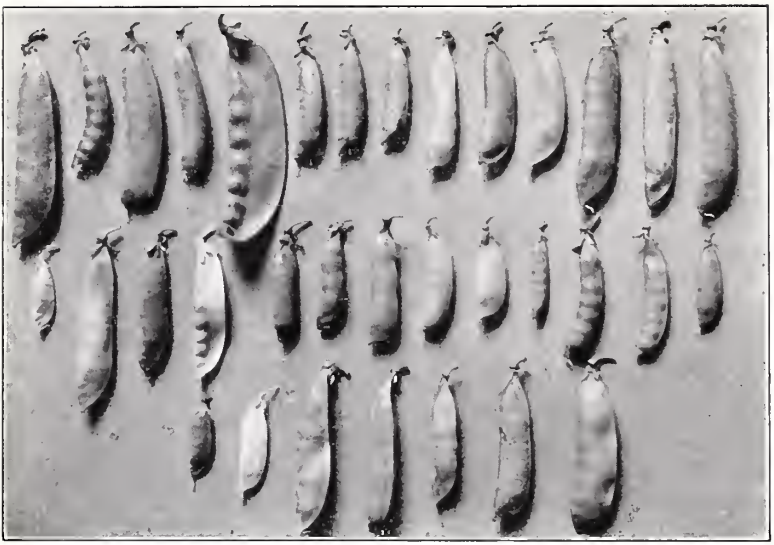


Fig. 4. Typical pods from thirty-four varieties of peas, showing enormous variability in hereditary pod length. Several wild types are represented. Quite Content and Goldkönig are two of the largest parchmented-pod varieties, while the fifth pod in the top row represents probably the longest podded pea known, the pods sometimes reaching 6 inches long and over an inch in width. These colossal pods are non-parchmented, very sweet and are eaten like string beans.

Fig. 5. Sketch of the wild ancestor of the cabbage, as it occurs on the chalk cliffs of Dover, England. After L. H. Bailey.

highlands, it more nearly resembles our conception of a weed than a valuable vegetable possibility. One wonders what primitive white man could see in this uninviting, bitter cliff plant, to cause him to throw about it his special care. But on this, as on the nature of woman, man can only speculate, for the eating of cabbage goes back far beyond our historical records and traditions. Among the Greeks it was held in little esteem, but the Romans were even poetic in its praise—a kind of praise accorded but rarely these modern days to such prosaic food. The Roman varieties are believed to have been of the loose, flat-headed type, the varieties with conical heads being considered as quite modern, possibly resulting from accidental crosses with the Chinese cabbage. Cabbages were cultivated by the ancient Celts of Scotland, and perhaps several of our forms were brought from Asia by the early migratory hordes. There are said to be no taxonomic varieties of the wild cabbage, although it is a very variable species. Of cultivated varieties—their name is legion. For it is impossible to call to mind a plant that has varied so in every part of its structure, from the shape of its roots to the crown of its flower stalk. Three hundred or more years ago, a turnip-rooted form was grown in Bavaria and a somewhat similar form is now grown in some parts of France. In kohl-rabi, the stem has changed into a juicy mass of edible tissue; in the common "boiled dinner," sauer-kraut, slaw type of cabbage, the stem spaces between each leaf (internodes) have become shortened and a head formed, a character present only to a very limited extent in the wild type. In leaves, variation has given us the red and crinkly Savoy types. Cauliflower and broccoli are simply cabbages in which the flowering stalk is much shortened and increased in size, and the development of many closely packed aborted flower buds brought about. In brussels sprouts, a large number of small heads have been substituted for the usual single large head. The Georgia collards are headless like the wild cabbage, as is also the kale and the giant cabbage kales of Wales and the Channel Islands. The latter produce stems of sufficient height to make canes and to use as cow-shed rafters, a length of 8-9 feet being not uncommmon.

When and where these numerous variations occurred, the records tell us but little. Cauliflower appears to have been known to the Greeks and Romans in a form somewhat resembling a poorly grown broccoli. According to Pickering, cauliflower was first mentioned in 540 B. C. A German writer, Hehn, says true cauliflower is of eastern origin and came to Europe via Venice and Antwerp. In the 12th century, the Moors of Spain are said to have written about it and to have received it from Syria. When first brought to western Europe, it was called "cabbage of Cyprus" possibly referring to the place where the best seed was grown. Brussels sprouts, kohl-rabi, and forms corresponding to collards seem to have been known in ancient times, as also were the red and Savoy types. Sauer-kraut, strange as it may seem, is said to have been introduced into Germany, through Russia, from Asia.

Almost as remarkable as the diversity of cabbage forms, are those coming from the wild lettuce, a roadside weed many of you no doubt have trampled under foot many times without ever once associating it with the

toothsome salad of your dinner courses. This common waste-land weed, *Lactuca scariola,* is not at first sight a very prepossessing forbear, and many a gardener would look in vain for resemblances to our cultivated lettuces. But to the botanist the mature plants of the wild and cultivated forms are very similar, and the differences which the epicurean and the gardener see are only minor and insignificant ones. Especially are these differences decreased when one contrasts a well grown plant of the wild lettuce with a somewhat poorly grown Romaine lettuce. Further, Professor Durst of the University of Illinois has made crosses between the wild and cultivated types, thus forging another link in the chain of evidence proving their close relationship. Although native to certain temperate portions of Eurasia, this weed has become common in most civilized countries. The botanist Boissier mentions a wild variety with crinkled leaves, which came from the mountains of western Asia. As to varieties, three are said to have been cultivated 2,000 years or more ago by the Greeks, while now 100 or more distinct varieties are common, of which the illustration shows 42 of the most important. The kings of Persia had lettuce salad on their tables in 300 B. C. The Moors of Spain grew several types, among them the Romaine. In fact, all of our present day types—the head, the Romaine, the curly loose leaved, the oak leaved and others—seem to have been well known in Europe preceding the Middle Ages.

From the kinds sold in our markets, one would never guess that peas exist in distinct varieties to the number of five hundred or more. These various kinds are grown in almost every temperate region of the world, including the Abyssinian plateau and the desert oases of Turkestan in western China. They differ from one another in seed color, shape, texture, sugar content, size; in number of peas per pod, in number of pods per plant (4-400 or more); in time of blooming; in time of maturing; in shape, size (1-5.5 inches), color (purple, canary yellow, green), texture of pod; in shape, size, color (red, pink, white), and number of flowers; in height of plant (6 inches to 10 feet); in shape, size and color of leaves; in number of branches and in the presence or absence of tendrils. Some varieties have bloomed, ripened their seed and died before others have reached the flowering stage. Some varieties will endure heat, others will endure a mild winter's cold. Some varieties will mature seed where other varieties will be an absolute failure. Some varieties have pods which are used like string beans, while others have a pod that would be as edible as dry corn husks. Such edible podded varieties are common in our Chinese markets. Most of these types probably were known to the Romans. The possible exception is the wrinkled-seeded peas, which by some authorities are said to have been discovered and introduced by the pioneer horticulturist, Thomas Knight, about a century ago. Perhaps this form occurred as a mutation in his experimental cultures, and realizing its value, he saved it. The edible podded peas were introduced into France from Holland about 1600 and soon took society's fancy. "The subject of peas continues to absorb all others," writes Madame de Maintenon in 1696, "the anxiety to eat them, the pleasure of having eaten them, and the desire to eat them again, are

the three great matters which have been discussed by our Princes for four days past. Some ladies even after having supped at the Royal table, and well supped too, returning to their own homes, at the risk of suffering from indigestion, will again eat peas before going to bed. It is both a fashion and a madness."

Botanists consider that some of the round, smooth seeded field peas with colored seed coats most closely resemble the wild ancestral species. DeCandolle believes western Asia was probably the original home of the pea, as there is every reason to believe its cultivation in eastern and southern Asia is comparatively recent. The Swiss lake dwellers of the Bronze Age had a small variety of pea said to somewhat resemble the "wild" field pea of southern Europe, and this is probably the earliest record of the cultivation of peas we possess. The writer has a large collection of peas, including many wild species and varieties from western and central Asia. From a study of these it appears most likely that our cultivated varieties arose from several wild forms belonging to the same species.

In contrast to the pea, cabbage, lettuce, and corn, cultivated asparagus is readily identified with its wild ancestor, a plant that to-day covers the waste steppes of south Russia by the billions, furnishing pasturage for thousands of horses and cattle. Although grown for over 2,000 years as a vegetable, there is very little distinction between the modern "most improved" varieties and those from these wild pasture lands. Why some plants such as this vary but little, while others vary greatly, is still one of the unsolved mysteries of heredity and variation.

Often associated in the dinner courses with such nutritious vegetables as peas and potatoes, are greens and buttered beets, these latter serving as roughage or "bulk." As for greens, they seem to have been in vogue from time immemorial and to have consisted of innumerable early spring plants that are tender, non-poisonous and at all eatable. Burdock, dandelion, lamb's quarter, wild mustard, and spinach are examples of the best known. The chards are beets with slender roots and large leaves, often with thick midribs. Together with the common red beet and the sugar beet, they trace their ancestry back to the common wild beet of Europe and Asia, although some authorities believe the chard to have come from a separate species, *Beta Cicla* L. This is often regarded as a form of *B. vulgaris*. Chard is of ancient cultivation, but the beet root was in all probability not eaten by the Greeks and Romans. In fact, beet roots as vegetables were little known in England as late as 1597. Lobel, writing in 1576, describes the turnip-rooted beet as "within and without wholly red, suffused with bloody gore, sweeter to the taste." Gerarde in his "Herball" (1597) writes: "What might be made of the red and beautifull roote (which is to be preferred before the leaves, as well in beautie as in goodnesse), I referre vnto the curious and cunning cooke, who no doubt, when he hath had the view thereof, and is assured that it is both good and holesome, will make thereof many and divers dishes both faire and good." The wild beet is a perennial, while the cultivated forms are biennials. The broad, flat-ribbed form of chard is of modern origin, although much older than several seed-catalogs indicate.

The dandelion is mentioned by Omar Khayyam as "that green herb" and probably originally migrated from Asia, although wild forms have been found isolated on certain mountain groups of our western states, possibly stranded there by the glacial "floods." Its use as food is comparatively modern, our liking for it having developed through its association with us as a medical herb. The chicories, including the endives, are still very wild looking, and show but slight effect from their 2,000 years or more sojourn with man. The endive chicory is a common annual weed in Sicily and in the grainfields of Egypt, just as its blue flowered perennial cousin, the ancestor of the witloof endive, is a common weed in the United States. The two cresses, the garden and water, have come to us as vegetables through association with us as simples or medical herbs. The same is true of celery, the ancestor of which abounds as a marsh, brook and drainage ditchplant in England and other parts of Europe. Celery is said to have been first blanched about 1670. In ancient Rome and Greece, it was regarded as a sort of parsley, and in Malta and many parts of the Near East, even to-day, celery is not blanched but the leaves are used as flavoring or as a garnish. One of the English herbalists some 400 years ago wrote "this is not woonted to be eaten, neither is it counted good for sauce." The popular Giant Pascal variety originated about 1890. Rhubarb is still another plant that was first a medicine, and then a vegetable, for in Elizabethan times, the leaves were regarded as the finest sort of greens. Only since the beginning of the 19th century has it been used for sauce, pies and tarts. The leaves are said to be unwholesome for some people, so they are rarely used for greens in these days. The ancestral wild type is common along the Volga River in Russia, while the mountains of eastern Asia are full of closely related species.

Turnips, carrots, parsnips and radishes trace their ancestry back to a very weedy lot of forbears, which many of them tend to resemble even now when growing conditions are not of the best, as is the case with most of my neighbor's radishes. Long, stringy, woody, wiry roots about an eighth of an inch in diameter with very large healthy tops are all that his arduous labor in amateur gardening has brought him. So that upwards of 3,000 years of cultivation have not done much for this vegetable. In the Far East are several queer forms of radishes: one known as rat-tail radish has seed pods often over a foot long, and these are picked as capers. In Japan, the cost of living is partly deduced from the cost of daikon, the giant winter radish, which is one of the principal winter vegetables of the poor people. On the Great Pyramid of Egypt, there is said to be an inscription in Egyptian characters, telling how much was expended in radishes, onions, and garlic for the workmen. *Daucus Carota* or Queen Anne's Lace is the wild form of the cultivated carrot. Both it and parsnips are so variable that improved varieties have been obtained directly from wild plants by a few generations of selection. Giant rooted forms of carrot are known in the Orient.

Perhaps, in an account of this sort, one should not forget to give honorable mention at least to the pungent horse-radish and the odoriferous alliums. The former is a somewhat common wild plant in eastern

Europe, in Finland and Russia, and in western Siberia and Turkey. Horse-radish is another one of the many vegetables we have received through the medieval gardens of medicinal herbs. Gerarde, an old herbalist, tells of the antipathy between the horse-radish and the grapevine. He writes: "Divers thinke that this Horse Radish is an enimie to Vines, and that hatred between them is so great that if the rootes heerof be planted neere to the vine, it bendeth backward from it as not willing to have fellowship with it." Another 16th century authority writes advising the use of the roots as a condiment in case only of strong laboring men, as "it is too strong for tender and gentle stomaches."

The onion tribe has been long with us, all of them except chives being of ancient cultivation. The Romans avoided garlic on account of its offensive odor, but the Emperor Nero used leeks and oil for his voice. In some countries they were associated with religious ceremonies, and in Egypt, the garlic was sacred to the swearing of oaths. At least seven distinct species, no doubt including many forms, have contributed the numerous cultivated varieties. *Allium Cepa* is the most important of these for from it the many ordinary kinds of onions have been derived. This species, as well as the others, is still common in a wild state in Eurasia.

In the more or less haphazard process of finding suitable vegetables, many species have been tried out and for some reason cast aside, so that our present common vegetables are a selected lot, even though the selection has been often largely determined by chance and prejudice.

A table of the various vegetables giving their common names, scientific names, probable antiquity of cultivation and their country of origin, is appended. The letters indicate the probable length of cultivation.

A—a species cultivated for more than 4,000 years.

B—a species cultivated for more than 2,000 years.

C—a species cultivated for less than 2,000 years.

D—a species cultivated very anciently in America.

E—a species cultivated in America before 1492 without giving evidence of great antiquity of culture.

F—a species or subspecies of very recent domestication.

Common Names	Scientific Name	Date	Origin
Artichoke, Globe	*Cynara Scolymus* L.	C	Southern Europe, Northern Africa, Canary Islands.
Artichoke, Jerusalem	*Helianthus tuberosus* L.	E	Eastern North America.
Asparagus	*Asparagus officinalis* L.	B	Europe, Western temperate Asia.
Bean (Broad or Windsor)	*Vicia Faba* L.	B(?)	Temperate Europe.
Bean (Pole Lima)	*Phaseolus lunatus* L.	E	Tropical America, Peru, Brazil.
Bean (Bush Lima)	*Phaseolus lunatus* L.	F	Eastern North America.
Bean (String, etc.)	*Phaseolus vulgaris* L.	D	Western South America.
Bean (Tepary)	*Phaseolus acutifolius* Gray	D	Southwestern United States.
Bean (Adzuki)	*Phaseolus angularis* Willd.	B(?)	China, Japan.
Beet (Chard)	*Beta vulgaris* L.	B	Canary Islands, Mediterranean region, Western temperate Asia.
Beet (Root)	*Beta vulgaris* L.	B	Europe, Mediterranean region.
Broccoli	*Brassica oleracea* var. *botrytis* DC.	B	Western Asia.
Brussels sprouts	*Brassic oleracea* var. *gemmifera* DC.	C	Belgium (?)
Cabbage	*Brassica oleracea* L.	A	Western Asia.
Cabbage (Chinese)	*Brassica Pe-tsai* Bailey	B	China, Japan
Carrot	*Daucus Carota* L.	B	Europe, Western temperate Asia.
Cauliflower	*Brassica oleracea botrytis* DC.	B	Western Asia.
Celeriac	*Apium graveolens* L. var. *rapaceum* DC.	C	Europe.
Celery	*Apium graveolens* L.	B	Temperate and Southern Europe, Northern Africa, Western Asia.
Chives	*Allium Schoenoprasum* L.	C	Temperate Europe, Siberia, Northern North America.
Corn (field)	*Zea Mays* L.	D	Mexico, Northwestern South America (?)
Corn (sweet)	*Zea Mays saccharata* Sturt.	E	Eastern North America, Mexico.
Cress (garden)	*Lepidium sativum* L.	B	Persia (?)
Cress (water)	*Radicula Nasturtium-aquaticum* L.	B	Europe, Northern Asia
Cucumber	*Cucumis sativus* L.	A	India.
Cucumber (gherkin)	*Cucumis Anguria* L.	F	West Indies.
Dandelion	*Taraxacum officinale* Weber	C	Europe and Asia.
Egg Plant (aubergine)	*Solanum Melongena* L.	A	India, East Indies
Endive	*Cichorium Endivia* L.	C	Mediterranean region, Caucasus, Turkestan.
Garlic	*Allium sativum* L.	B	Kirghis desert region in Siberia.
Horse radish	*Roripa Armoracia* L.	C	Eastern temperate Europe, Western Asia.
Kale	*Brassica oleracea* var. *acephala* DC.	B	Europe.
Kohl-rabi	*Brassica oleracea* var. *caulo-Rapa* DC.	B	Europe.
Leek	*Allium Porrum* L.	B	Mediterranean region, Egypt.
Lentil	*Lens esculenta* Moench	A	Western temperate Asia, Greece.

Common Names	Scientific Name	Date	Origin
Lettuce	*Lactuca sativa* L.	B	Southern Europe, Western Asia.
Mushroom	*Agaricus campestris* L.	C	Northern hemisphere (Europe).
Okra (gumbo)	*Hibiscus esculentus* L.	C	TropicalAfrica.
Onion	*Allium Cepa* L.	A	Persia, Central Asia.
Onion (Welsh)	*Allium fistulosum* L.	C	Siberia, Kirghis desert region to Lake Baikal.
Parsley	*Petroselinum hortense* Hoffm.	C	Southern Europe, Algeria, Lebanon.
Parsnip	*Pastinaca sativa* L.	C(?)	Central and Southern Europe.
Pea (garden)	*Pisum sativum* L.	A	Western and Central Asia, Southern Europe, North India (?)
Pea (wrinkled garden)	*Pisum sativum* L.	F	England (?)
Pea (edible podded)	*Pisum sativum* var. *saccharatum* Hort.	B	China (?)
Pepper (red)	*Capsicum annuum* L.	E	Brazil, Western South America.
Potato	*Solanum tuberosum* L.	E	Chile, Peru, Ecuador.
Potato (sweet)	*Ipomoea Batatas* Poir.	D	Tropical America.
Pumpkin	*Curcurbita Pepo* L.	E	Sub-tropical and tropical America.
Radish	*Raphanus sativus* L.	B	Temperate Asia.
Radish (Japanese Giant or Daikon)	*R. sativus* L.	(?)	Japan, China.
Rhubarb	*Rheum Rhaponticum* L.	C	Desert and sub-alpine regions of Southern Siberia, Volga River.
Rutabaga	*Brassica oleracea* var. *Napo-Brassica* L.	C	Europe.
Salsify or Oyster plant	*Tragopogon porrifolius* L.	C(?)	Southeastern Europe or Algeria.
Spinach	*Spinacia oleracea* L.	C	Persia, S. W. Asia.
Spinach (New Zealand)	*Tetragonia expansa* Thunb.	F	New Zealand.
Squash (winter)	*Cucurbita maxima* Duch.	E or D	Tropical America.
Squash (summer)	*Cucurbita Pepo* L.	E	Temperate or tropical America.
Tomato	*Lycopersicon esculentum* Mill.	F	Peru.
Tomato (currant or raisin)	*L. pimpinellifolium* Dumal	F	South America.
Turnip	*Brassica Rapa* L.	A	Europe.
Yams	Several sp. including *Dioscorea alata* L. and *D. Batatas* Decne.	B(?)	Southeastern Asia, Africa and South Pacific Islands.

Orland E. White

NOTICES

The Garden is open free to the public daily, from 8 a. m. until dark; on Sundays and holidays from 10 a. m. until dark. The Laboratory Building, containing the library, herbarium, and offices, is open daily (except Sundays), from 9 a. m. until 5 p. m. (Saturdays, 9-12). The Conservatories are open April 1-October 1, 10 a. m.-4:30 p. m. (Sundays, 2-4:30); October 1-April 1, 10 a. m.-4 p. m. (Sundays, 2-4).

To Reach the Garden take Broadway (B.-M.T.) Subway to Prospect Park Station; Interborough Subway to Eastern Parkway-Brooklyn Museum Station; Flatbush Avenue trolley to Empire Boulevard; Franklin Avenue, Lorimer Street, and Tompkins Avenue trolleys to Washington Avenue; St. John's Place trolley to Sterling Place and Washington Avenue; Union Street and Vanderbilt Avenue trolleys to Prospect Park Plaza and Union Street.

Entrances— On Flatbush Avenue (1) near Empire Boulevard, and (2) near Mt. Prospect Reservoir; on Washington Avenue, (3) south of Eastern Parkway, and (4) near Empire Boulevard; on Eastern Parkway, (5) west of the Museum building.

The street entrance to the Laboratory Building is at 1000 Washington Avenue, between Eastern Parkway and Empire Boulevard and opposite Montgomery Street.

The LEAFLETS are published weekly or biweekly from April to June, and September to October, inclusive, by The Brooklyn Botanic Garden, 1000 Washington Avenue, Brooklyn, N. Y.

Telephone: 6173 Prospect. Mail address: 1000 Washington Avenue, Brooklyn Botanic Garden, Brooklyn, N. Y.

This Number Completes Series XV, 1927.

WHAT PRICE CHRISTMAS GREENS?

History of Use of Christmas Greens

We shall probably never know just how the practice of using evergreens at Christmas time originated, but this seems to be certain, that it is a very ancient custom. Long before the Christian era, places of public worship were decorated with evergreens—branches of fir, pine, cedar, and box, as shown in the books of Isaiah and Nehemiah. Holly or Holy (called by Turner, in his Herbal, the "Holy Tree") was apparently first used at Christmas by the early Christians at Rome. It had been used at the feast of the Saturnalia as an emblem of peace and good will, and was simply transferred to the new Christian festival. The Druids decorated their dwelling places with evergreens during winter "that the sylvan spirits might repair to them, and remain unnipped with frost and cold winds, until a milder season had renewed the foliage of their darling abodes."

Whatever the origin, we can at least be certain that the custom is a perfectly natural one, for it is just as much part and parcel of human nature to decorate houses and churches for special occasions as it is to dress one's own person for these events. In a similar way, although to a lesser extent, we use appropriate decorations on other holidays—lilies and other flowering bulbs at Eastertide; flags for the Fourth-of-July; autumn leaves, pumpkins, etc., for Thanksgiving. The use of evergreens at Christmas might well betoken, at St. Winifred has said, an everlasting life; while the red berries of holly or black alder, and the flaming bracts of the Poinsettia add a note of good cheer that is infectious and inspiriting.

The Problem of Christmas Decorations

And so, with the approach of every Christmas season, family councils and secret conferences are held throughout this broad land toward the perfection of plans for the great festivities. Among the subjects for discussion is the most important one of the nature and potential sources of the decorations. What shall they be? Wreaths fashioned of holly, laurel, or ground pine, or even of red tissue paper; ropes of evergreens, or just branches of holly, laurel, and mistletoe?

Of late years much has been said and written about the conservation of living plant materials used for decoration during the Christmas Holidays. Because of the entirely natural fear of the speedy extermination of some of our choice evergreens like mountain laurel

Brooklyn Botanic Garden Leaflets

Series XV Brooklyn, N. Y., November 30, 1927 Nos. 10 - 12

and holly, there are some who urge us not to buy them, or advise us to preserve them and use them from year to year, or to use artificial substitutes instead. Certainly this is one solution of the difficulty, and doubtless a good one, but we believe that there is another solution, far more satisfactory, from an economic as well as an aesthetic point of view.

Past and Present Conditions

Not very long ago, when about three-quarters of our whole population lived on farms, or at least was classed as rural, there was no problem of Christmas greens. Very often the farm itself supplied the decorations needed: mountain laurel from the pasture lot or wood lot; branches of pine and hemlock, and streamers of ground pine, as well as a Christmas tree, perhaps, from the wood lot; and black alder or winterberry, with its wealth of bright red berries, from the swamp. And if these woodsy things didn't come from the particular farm in question, but from someone else's—or more likely from the "woods" —a general term for wild land within accessible distance,—nobody cared and no questions were asked.

But now, in 1927, with the population double what it was 35 years ago, and more than half of it living in cities, the situation is different. There has gradually developed a lucrative business of collecting Christmas greens, shipping them to the cities and marketing them to the city dwellers. Very little of this material is collected and shipped by the landowners themselves: by far the larger part is obtained by regular collectors who make a business of this work, ransacking the woods with or without permission of the owners—usually without—breaking off and carrying away branches of mountain laurel, and (in the South) holly, literally by the tons; tearing up the lovely creeping colonies of ground pine wherever they can be found.

Nowadays also, the extensive use of the automobile has made it possible to greatly increase the radius of operations for the collectors. And not only for the collectors. The family car is often requisitioned as the Christmas season approaches, and the whole family is transported in an hour's time to some wild, wooded section remote from the city where Christmas greens seem to be anybody's for the asking. There is no thought of the trespass committed—no "wilful intent." Evidently this practice harks back to olden times when the woods or wild land were regarded as public property.

Conservation

The whole problem of the conservation of our Christmas greens is of course bound up with the much larger one of the conservation of our natural resources, a question which, from the nature of the case, looms larger and larger with each new year as our population increases and the demands upon our natural resources multiply.

As now generally defined, conservation means a wise use of the gifts of nature—a use, which, in the case of "renewable" resources like the forests, and plant and animal life in general, is so planned

that a permanent supply of such resources may be always assured for the future. In accordance with this interpretation of conservation, how are we then to continue to use living plants for Christmas decoration and yet provide for a future supply?

Inventory of Stock on Hand

Before answering this question, let us, like the dealer in merchandise who fears a shortage in some of his wares, take an account of the resources at hand. What are the plants which we in the Eastern United States, and more particularly in the Northeast, use most for Christmas decoration, where do they grow, and how abundant are they?

1. American Holly—*Ilex opaca.* Because of its striking combination of dark, evergreen leaves, and lustrous, red berries, it ranks first in importance. Growing naturally from Massachusetts to Florida, usually not far from the coast, and in the valley of the Mississippi from Southern Indiana and Illinois southward to the Gulf; also through Missouri, Arkansas, Eastern Oklahoma and Louisiana to Texas, it is rare east of the Hudson, and becomes increasingly common and of larger size as one goes southward. It is most abundant and of its largest size—rarely 100 feet high with a trunk 4 feet in diameter—on the bottomlands of the streams of northern Louisiana, southern Arkansas, and eastern Texas—although ordinarily much smaller than this—with a trunk 2 to 3 feet in diameter, and a height of 40 to 50 feet. It is often stated that holly is dioecious, i.e., some plants staminate, and others pistillate, but this is not the case. However, for practical purposes, it might just as well be; for although, as far as the presence of the essential organs (stamens and pistils) goes, the flowers are perfect; yet in some individuals the pistils are abortive and never develop into the berries, while in others the stamens, although formed, are sterile. These latter plants, of course, are the ones that bear the berries.

No one has yet made a survey of the amount of holly available in the United States. The total amount of the existing growth must reach a large figure, and yet only a small proportion of this is accessible to collectors. The slow habit of growth of the plant is a serious handicap to its natural perpetuation, when considered in connection with the rate at which it is being used. How long will the supply last? One can only venture a rather indefinite statement that at the present rate of consumption the plant will probably become practically extinct in all of its easily accessible haunts before many years have passed. In this connection should be mentioned two close shrubby relatives of the American Holly that one meets frequently along the southern coast region: *Ilex vomitoria* (the Cassena), which also, like the American Holly, occurs inland, and *I. Cassine* (the Dahoon), which grows in swamps from southern Virginia southward. Both these are potential substitutes for the American holly, and one of them, at least—the Cassena—has appeared in New York markets. They both have red berries, but the leaves are not spiny, as in the American holly.

2. Mountain Laurel—*Kalmia latifolia.* Given its common name by the early colonists on account of the resemblance of its dark evergreen leaves to the true laurel (*Laurus nobilis*) of classical fame, which is a native of the Mediterranean region, but long cultivated in Northern Europe as a greenhouse plant. However, the mountain laurel is not a real laurel at all, but a member of the Heath family—a near relative of the rhododendrons and azaleas; and a cousin of the blueberries, huckleberries, cranberries, bearberry, trailing arbutus, and wintergreen. Like other members of the Heath family, it requires a somewhat acid soil for its best development.

Mountain laurel has a wide distribution in the United States, its range extending from New Brunswick to the northern shores of Lake Erie, south to Virginia, Ohio, Indiana, and Tennessee, and in the Appalachian Mountains to Georgia, and from western Florida through the Gulf States to western Louisiana. Usually shrubby—from 6 to 10 feet in height—in the southern Appalachians it often reaches the size of a small tree—rarely 30 to 40 feet high.

Not only at Christmas time, but at other seasons, particularly in the fall and winter, mountain laurel is much in demand as an ornamental plant for house interiors, and branches of it for this purpose are usually on sale at florists' stores at almost any time of the year.

As to the available supply, Mr. P. L. Buttrick,[1] the Secretary of the Connecticut Forestry Association, in an admirably written bulletin on the mountain laurel, says: "There is a much larger supply of laurel than of any other plant used for Christmas greens. . . . Probably there was less of our state flower in Connecticut when the Pilgrim fathers celebrated their first Thanksgiving than there is today. . . . Prolonged and intensive collecting of the foliage in any region would certainly exterminate the plant in that locality and has already made it somewhat rare in the vicinity of some of our large cities. But collecting, if properly regulated . . . could be carried on indefinitely without danger." These statements are of course intended to describe the situation in Connecticut alone; but in all probability they apply equally well to the conditions throughout the main part of the range of the mountain laurel.

3. Ground Pine—*Lycopodium complanatum* and *L. obscurum.* The Society of American Horticulturalists in their "Standardized Plant Names," have recommended the names "Groundcedar" and "Groundpine" for these two species respectively, but they are both commonly known as "Ground Pine." The latter species, particularly in its commoner variety (*dendroideum*) seems indeed more deserving of the name, because of its erect and rather symmetrical habit, appearing like some member of the pine family in miniature. However, these plants are only distant relatives of the true pines; they are more closely connected with the ferns, and are correctly known as members of the clubmoss group. *L. complanatum* (var.

[1] Buttrick, P. L. Connecticut's state flower, the mountain laurel, a forest plant. Marsh Bot. Gard. Publ. 1:1-28. *7 figs.* 1924.

flabelliforme) bears a succession of erect branches, which are fan-shaped and flattened, so that they come to lie in a more or less horizontal plane. A third species, *L. clavatum,* is occasionally used. The first two forms, and to a less extent the third, are of fairly common occurrence in the woods of the northeastern states.

In all these, the main stem runs along the surface of, or just below the ground, sending small rootlets into the soil at intervals. Unfortunately, but inevitably, in the gathering of the plant this creeping stem, together with its occasional rootlets, is torn up, so that after a collector has visited a colony of the plants and done his job thoroughly, it is "goodbye forever" to the clubmoss as a denizen of that particular woodsy haunt. Unless it is protected from further depredations, it is probable that the clubmoss, particularly of the species named, will soon become extremely rare everywhere, just as it now is in the neighborhood of large cities.

4. Black Alder or Common Winterberry—*Ilex verticillata.* One is apt to find this deciduous-leaved relative of the American holly, conspicuous with its clusters of bright red berries, clinging closely to its slender twigs, in almost any swamp or wet ground in the northeastern section of the United States, as far west as Wisconsin and Missouri, and along the coast to Florida. A closely related species, the smooth winterberry (*I. laevigata*), is scarcely enough different to be distinguished by the layman. Of late years the winterberry has become increasingly popular for Christmas decoration, its red berries being used for wreaths in combination with ground pine, or the branches, loaded with their shining red fruit, being made into bouquets with the mountain laurel. Although it has such a wide natural distribution, it is never very abundant, as a rule the bushes appearing only here and there in the swamps. Like the other species, as explained above, some of the plants have habitually abortive pistils, and so do not mature fruit.

5. Mistletoe—*Phoradendron flavescens.* This is a partial parasite, growing on the branches of various hardwood trees, the tree becoming, so to speak, the root of the plant; for although mistletoe has its own green leaves, it derives its water and nutrient salts, which plants ordinarily get through their roots, *via* the branches of its host.

Although with much the same range as the American holly, it does not grow quite so far north, New Jersey and Pennsylvania being its northern limit. In the southeastern states it is very common, while a closely related form is abundant in Arizona and the Pacific coast. Since it often grows in inaccessible locations, i.e., at the tips of branches of tall trees, its ultimate extermination by collectors is improbable; nor would this be a great calamity in view of its destructiveness to forest and shade trees, and of its unsightliness in its native habitat. Furthermore, mistletoe is never used for decoration on such a large scale as the holly, laurel, and ground pine, its value being more historic and symbolic. For this purpose small sprigs are all that are needed.

Suggestions Toward a Solution of the Problem

We are ready, then, to answer the question as to the best policy to be pursued in regard to the future use of Christmas greens.

1. First of all, *let us encourage the growing and marketing of Christmas greens on a commercial scale by nurserymen, landowners, and others who may be interested.* Already a firm of nurserymen on the Pacific Coast is raising and marketing English holly on a large scale. Regarding the cultivation of hollies, Mr. P. L. Ricker,[2] President of the National Wild Flower Preservation Society says:

"There is a good profit for nurserymen, or others, in growing berry-bearing holly plants for the market. Three- to six-inch cuttings from the heaviest berry-bearing trees taken in October or November without removing the leaves should be planted in a box six inches deep and containing a one inch layer of moss in the bottom and two inches of sand. The box should be covered with glass and kept in a greenhouse or room ranging from seventy to eighty-five degrees during the day and preferably not below sixty degrees at night. A good watering once or twice a week is ordinarily sufficient. The cuttings should be well calloused in thirty days and have roots one-half to one inch long in sixty days, after which they may be potted up and placed outdoors as soon as the danger of frost is over. Potting soil should preferably contain one-quarter by bulk of sawdust that has been rotting four or five years to aid in keeping the soil acid, although aluminum sulphate at the rate of thirty pounds to a cubic yard of soil may be used and added subsequently in small quantities. The plants also may be mulched with the well-rotted sawdust, oak, pine or laurel leaves. Plants should make nine to twelve inches growth the first and each subsequent year.

"A few male [pistil-aborted] plants should be planted in all nurseries to insure fertilization, and the cuttings may be selected from large non-berry-bearing trees. Most of the female [stamens-aborted] plants should bear berries in three to four years. Some nurserymen graft a female branch into a male tree so as to form two main trunks, male and female side by side. Berry-bearing plants, from cuttings or grafts, two to eight feet tall, sell from seventy-five cents to $10, and a good crop of plants to cut for branches for the Christmas market when they are five to six years old should bring proportionate returns. Fair-sized single branches sell in the market for from twenty-five to fifty cents each. The winterberry may be propagated similarly to the holly."

On the subject of growing mountain laurel for the market, Mr. P. L. Buttrick[3] says:

"If we accept the view . . . that the use of laurel for decorative purposes is legitimate, and at the same time recognize that overcollection could eventually cause its extermination, the logical con-

[2] Ricker, P. L. Preserving our Christmas greens. Nature Magazine, 8:295-298. *6 figs.* 1926.

[3] L. c. pp. 25, 26.

clusion seems to be to encourage the production of a supply for the market.

"From the point of view of those interested in the protection of our wild plants and natural scenery there need be no objection to the use of laurel leaves for decoration if they were grown for the purpose—any more than to the use of hothouse roses.

"From the point of view of the forester the growing of laurel for the market would be very desirable. One objection to forestry as a business is that it takes so long to mature a crop of timber. Under ordinary conditions twenty years is the shortest period which can produce a wood crop of any sort. Such a short period produces only firewood, which does not yield much revenue, but if mountain laurel were already established in a piece of woods, a crop could be produced from sprouts *every four or five years.* [Italics ours.] In other words at least four crops of laurel can be produced to one of trees, and on the same area—provided the plants are not so thick as to interfere with the trees. Assuming that the owner receives only fifty cents an acre for the collecting privilege, or sells the cut laurel at one dollar per hundred pounds, it would often pay the taxes on the land, thus making the final return from the timber greater. . . . To secure a good second crop the cut should be made close to the root and those parts of the plant not useful for decorating purposes should be discarded.

"What are the possibilities of farmers and other owners of woodland actually handling their laurel in this way? In the neighborhood of cities, collecting privileges are sometimes sold, while some farmers cut the laurel themselves and bring it in to dealers. Farther back in the country, owners are less apt to demand a price for collecting privileges and are sometimes indifferent when the plant is stolen from their lands. If every owner valued his laurel and demanded a price for it, several things would result. First, some collectors would go to those sections where, because of a super-abundance, it is regarded as something of a pest and therefore where they might expect to get it for little or nothing. This would result in its partial removal where it is too abundant for the good of the forest. Second, dealers who preferred to pay a reasonable price would be sure of a definite supply, which would lessen the danger of its being stolen indiscriminately. All these things would tend to build up a stabilized business in the growing and marketing of laurel instead of the present condition, which is unsatisfactory from a public-spirited viewpoint."

As to Christmas trees, the United States Forest Service has stated that the custom is so old, so well grounded and so venerated that, even if it were economically somewhat indefensible, these aspects will and should continue to outweigh economic considerations. And Dean Hosmer,[4] of the Cornell Forestry School, voices the opinion of foresters when he says, "Interestingly enough, however, economic

[4] Hosmer, R S. Are Christmas trees wrong? Nature Magazine, 4:325-327. *2 figs.* 1924.

factors as well as sentiment point to this as 'wise use,' With several of the species that yield the best Christmas trees, more money can be got by using them for this purpose than for any other. The Christmas tree is a legitimate by-product of the forest."

As to ground pine, it seems to us that its collection and sale should be discouraged, for, as already shown, of all the Christmas plant materials, this is the only one which is practically non-renewable.

2. All these plants, *i.e.,* mountain laurel, holly, species of ground pine, and black alder, should be protected on state land and public highways by rigid state laws. Already New York State has passed a law making it a misdemeanor to take mountain laurel, trailing arbutus, flowering dogwood, and pink lady's slipper from State or public land.

Further, laws regulating the collecting of mountain laurel, holly, ground pine, and black alder should be enacted similar in form to Connecticut's admirable law, whose provisions regarding mountain laurel are as follows:[5]

"(1) That no person shall collect it upon the land of another for commercial purposes without written permission of the owner filed with the clerk of the town in which the land is located.

"(2) That no bale, box, package, or load containing mountain laurel can be legally transported or shipped by rail or highway unless it is tagged to indicate the name of the owner of the land from which it was taken and the name of the collector.

"(3) The owner or agent may arrest without warrant any violator of this law and may be allowed court fees for so doing."

3. Finally, the people must be educated to respect property rights, and such education may properly and best be given in the school. From the standpoint of protection of our native plants, education is all important. Laws may be proposed and duly enacted, but, as we are learning, if they are not backed by general public sentiment, they are useless.

The landowners, too, on their part, when they wish to or are willing to dispose of their plant material, should regard it in the light of a crop, to be harvested periodically according to the principles of conservation, and for a proper monetary return.

We believe that the suggestions outlined above point the way to a practical solution of the whole problem.

ARTHUR HARMOUNT GRAVES.

[5] Buttrick, P. L. l. c. p. 22.

The LEAFLETS are published weekly or biweekly from April to June, and September to November, inclusive, by The Brooklyn Botanic Garden, 1000 Washington Avenue, Brooklyn, N. Y.

Telephone: 6173 Prospect. Mail address: Brooklyn Botanic Garden, Brooklyn, N. Y.